Engineering Library

With METALLURGICAL SUPPLEMENT.

JUL 11 1930

The Engineer.

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VOL. CXLIX.—No. 3885] LONDON: FRIDAY EVENING, JUNE 27, 1930 [PRICE {WITH SUPPLEMENT} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

WIRING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Friday, 11th July, 1930, for ELECTRIC WIRING at the Research Laboratory, Princes Risborough, Bucks. Drawings, specification, and a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 5270

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—

3 RAIL MOTOR COACHES, 2ft. 6in. gauge, (a) Steam Driven, or (b) Petrol Driven.

Tenders due 18th July, 1930.

Forms of Tender available from the above at a fee of 5s., which will not be returned. 5278

Crown Agents for the COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/2255.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of HONG KONG for three years' service and possible permanency. Salary £460, rising to £500 a year by annual increments of £20, and then, in the event of the appointment being made permanent, by further annual increments of £20 to £700 a year, and thereafter by annual increments of £25 to £1000 a year, payable locally in dollars under a compensation scheme at present in force at a favourable rate of exchange. Free passages. Candidates, unmarried, age 24 to 30, must have passed Sections A and B of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from these examinations. Must be good draughtsmen, well up in levelling, land and marine surveying and sounding and must have had some experience in design and construction of port works generally.

M/2095.—ASSISTANT TOWN PLANNING OFFICER REQUIRED by the LAGOS EXECUTIVE DEVELOPMENT BOARD for two tours of 12 to 18 months' service, with possible extension. Salary £480, rising to £720 a year by annual increments of £30, and thence rising to £920 a year by annual increments of £40. Seniority pay of £72 a year on reaching salary of £720 a year. (The question of paying a higher commencing salary than the minimum of the foregoing scale will be considered in the case of the selection of a very highly qualified officer). Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, 24 to 30 years of age, should hold the Diploma of the Town Planning Institute of Great Britain or such other Degree or Diploma recognised as its equivalent. Must have had good theoretical training in town planning at a University or School recognised by the Town Planning Institute of Great Britain. Should have had practical experience in the preparation of statutory municipal town planning schemes and re-planning schemes for existing areas. Should have a knowledge of the law in relation to town planning practice.

M/2065.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of TANGANYIKA TERRITORY for Roads Construction for a tour of 20 to 30 months' service. Salary £480 to £600 a year, according to experience and qualifications. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, 28-35 years of age, must have had experience of railway or road contracting engineers' work abroad. Must be able to undertake the construction of earth and gravelled roads, including earthworks, steel, reinforced concrete and timber bridges and auxiliary works. Preferably should have had experience of survey and location works, and preferably should be Associate Members of the Institution of Civil Engineers.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 5286

Heriot-Watt College, Edinburgh

DEPARTMENTS OF MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING.

MECHANICAL ENGINEERING :
PROFESSOR A. E. HORNE, O.B.E., B.Sc., M.I. Mech. E., A.M.I.C.E.
ELECTRICAL ENGINEERING :
PROFESSOR F. G. BAILY, M.A., M.I.E.E.
FULL-TIME DAY DIPLOMA COURSES leading to professional recognition.
CLASSES COMMENCE 14th OCTOBER.
Full particulars from the College.
J. CAMERON SMAIL, O.B.E., Principal. 5268

Northampton Polytechnic INSTITUTE.
ST. JOHN-STREET, LONDON, E.C. 1.

FULL-TIME COURSES IN ENGINEERING

are provided as follows :—
MECHANICAL,
CIVIL,
AERONAUTICAL,
ELECTRICAL AND
ELECTRICAL COMMUNICATION.

Students are able to qualify for the Polytechnic Diploma and (if Matriculated) the Engineering Degree of London University.

Entrance Examination, Wednesday, 16th July, 1930. For prospectus apply to
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The Engineer

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Armstrong College.

NEWCASTLE-UPON-TYNE.

(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
4056 Newcastle-upon-Tyne.

The University of Leeds.

DEPARTMENT OF AGRICULTURE.

APPLICATIONS are INVITED for the POSITION of ASSISTANT LECTURER (AGRICULTURAL ENGINEERING). A sound training in engineering essential. Salary £350.—Further particulars can be obtained from the REGISTRAR, The University, Leeds, by whom applications will be received up to 12th July, 1930. 5266

PUBLIC NOTICES

Indian Institute of Science, BANGALORE.

CHAIR OF ELECTRICAL TECHNOLOGY.

APPLICATIONS are INVITED for the PROFESSORSHIP of ELECTRICAL TECHNOLOGY in the Indian Institute of Science, Bangalore. Experience in teaching and research work an essential qualification.

Salary Rs. 1250-50-1500 per month, with an overseas allowance of Rs. 500 per month (together about £1500, rising to £1700 p.a.), free quarters, a retiring allowance of 10 per cent. of the total salary and an allowance towards first passage.

The appointment will be made for six years in the first instance.

Applications should be addressed to Dr. M. O. FORSTER, F.R.S., c/o Messrs. Jeremiah Lyon and Co., Ltd., 4, Corbet-court, London, E.C. 3, before 28th July. P7165

Borough of Acton.

TO ENGINEERING CONTRACTORS.

SEWAGE PUMPING STATION.

The Town Council invites TENDERS from engineering contractors with experience in the construction of Sewage Pump Wells, Sumps, Engine-houses and Foundations, for the CONSTRUCTION of a NEW PUMPING STATION and other INCIDENTAL WORKS at the Sewage Pumping Works, Warple Way, Acton, W. 3.

Specification may be seen and quantities, form of Tender and other particulars obtained upon application to the Borough Engineer, W. G. Cross, Assoc. M. Inst. C.E., on payment of a deposit of £10, which will be returned on receipt of a bona fide Tender and the return of all loaned documents and plans.

Sealed Tenders, endorsed "Pumping Station," addressed to the undersigned, must be delivered on or before 3 p.m., 14th July, 1930.

The Council does not bind itself to accept the lowest or any Tender, and canvassing in any form is prohibited.

JOHN MORGAN,
Town Clerk.
Municipal Offices, Acton, W. 3.
21st June, 1930. 5260

PUBLIC NOTICES

Bombay, Baroda and Central INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Wednesday, 16th July, TENDERS for the SUPPLY of :—

1. BOILERS FOR LOCOMOTIVES.
2. SIGNALLING CABLES.
3. WHEELS AND AXLES FOR WAGONS.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of £1 each for Nos. 1 and 2, and 10s. each for No. 3 (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices : The White Mansion,
91, Petty France, Westminster, S.W. 1.
23rd June, 1930. 5269

Royal State Railways of Siam.

NOTICE.

Sealed TENDERS for the SUPPLY of SUPERSTRUCTURES of STEEL RAILWAY BRIDGES for B.E. 2473 will be received by the SUPERINTENDENT OF STORES, Royal State Railways of Siam, until Fourteen o'clock on November 8th, 1930.

Blank Tender forms, general conditions and specifications can be obtained from Messrs. Sandberg, 40, Grosvenor-gardens, London, S.W. 1, upon payment of £2 per set, which sum will not be refunded.

Right is reserved to reject any or all Tenders. 5275

RAILWAYS.

4-WHEELED COVERED WAGONS (Metre Gauge).

The Consulting Engineers to the Mysore Railways (Messrs. RENDEL, PALMER and TRITTON, 55, Broadway, Westminster, S.W. 1) invite TENDERS for 60 COVERED WAGONS.

Specifications and Tender forms can be obtained from their office on payment of 5s. (which will not be returned).

Tenders must be submitted not later than Wednesday, 16th July, 1930. 5257

ROLLTIC LIMITED
(In Voluntary Liquidation).

Tenders are Invited for the PURCHASE in One Lot of the GOODWILL, PATENTS, STOCK-IN-TRADE and PLANT and MACHINERY of ROLLTIC LIMITED, used in the manufacture of Ticket Issuing Machines carried on by that Company.

Tenders, which must be on the form contained in the particulars and conditions of sale, are to be sent to the Liquidator, Mr. NORMAN DENIS GRUNDY, Chartered Accountant (Everett, Morgan and Grundy), 90, Cannon-street, London, E.C. 4, and marked "Tender re Rolltic Limited," on or before the 17th day of July, 1930.

Particulars and conditions of sale with form of Tender may be obtained of the Liquidator as above. 5258

Indian Research Fund Association.

(MALARIAL ENGINEER).

WANTED, for Service with the Malaria Survey of India, Kasauli, a fully qualified and competent CIVIL ENGINEER, with practical experience of Drainage and other problems connected with the Prevention of Malaria.

Appointment will be made on basis of three-yearly contract, subject to one year's probation. Salary Rs. 1300/- per mensem, rising by Rs. 100 annual increment to Rs. 1500/- in last year of contract (equivalent at present rate of exchange to about £1170-£1350 per annum), with usual departmental travelling allowance and halting allowance; salary to start from date of landing in India. Free passages out and home, 1st Class "P" Peninsular and Oriental, or equivalent, at termination of contract or period of employment; return passage also paid if first year's probation not satisfactory. Usual service conditions regarding leave, i.e., one month's leave with full pay after eleven month's service or equivalent proportion, cumulative; with usual casual leave not exceeding fifteen days in the year.

A suitable candidate would have every prospect of renewing agreement.

Apply, stating qualifications and experience, with copies of relevant testimonials, to the SECRETARY, INDIAN RESEARCH FUND ASSOCIATION, Simla, India, from whom any further information as to qualifications most desired or on any other points can be obtained. The applications should reach the Secretary, Indian Research Fund Association, Simla, by the 15th August, 1930, at the latest. 5220

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PUBLIC NOTICES

County Borough of Swansea.
SEWERAGE AND DRAINAGE DEPARTMENT.
CIVIL ENGINEERING ASSISTANT REQUIRED for the Design of Sewerage Works, including Sewage Pumping Stations, and Auxiliary Works (not mechanical, although mechanical knowledge advantageous), in connection with a Main Drainage Scheme.
Candidates must be thoroughly capable of undertaking all necessary calculations and the design for deep pump wells, settling tanks, &c., constructed in reinforced concrete or mass concrete.
Preference will be given to applicants who have passed the examination for Associate Membership of the Institution of Civil Engineers or hold an approved Engineering Degree.
State age, general civil engineering experience, design of constructional steel and concrete works and buildings, surveying, levelling, quantities, estimates, and experience in the design of sewerage or sewage disposal works.
Age not under 27. Salary £400 per annum. Appointment determinable by one month's notice on either side.
Forms of applications to be obtained from Mr. J. Richard Heath, Chief Engineer, Main Drainage Scheme, Guildhall, Swansea, to whom all applications, together with copies of three testimonials, must be delivered by 11th July, 1930.
H. L. LANG-COATH,
Town Clerk.
Guildhall, Swansea. 5261

Metropolitan Borough of Paddington.
APPOINTMENT OF WORKING ENGINEER.
APPLICATIONS are INVITED for the APPOINTMENT of a WORKING ENGINEER for the Central Baths, Porchester Hall, &c., at a commencing inclusive salary of £350 per annum.
The person appointed will be required to take charge of the engineering plant, including heating, electric lighting, ventilation and filtration. Age not to exceed 40 years.
The person appointed must produce a certificate of birth confirming statement of age; pass an examination by the Council's Medical Examiner; contribute to the Council's superannuation scheme; devote the whole of his time to the duties of his office; and not be directly or indirectly concerned in any business other than that of the Council.
Forms of application for the appointment may be obtained from the undersigned on receipt of stamped addressed foolscap envelope, and must be returned to me not later than 10 a.m. on Saturday, 12th July, 1930.
Personal canvassing, either directly or indirectly, will be a disqualification.
By Order,
W. F. ABBISS,
Town Clerk.
Town Hall, Paddington, W. 2,
24th June, 1930. 5277

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, as WORKS ENGINEER in London Factory, MAN of 30-38 years, who has had technical education, practical and executive experience in manufacture of accurate machinery. Fullest particulars.
Address, P7172, The Engineer Office. P7172 A

A MANUFACTURING FIRM in the Midlands REQUIRES a competent MECHANICAL ENGINEER, young and with active brain, capable of designing and improving the manufacture of existing All-metal Joiners' Tools. Generous remuneration to the right man.—Address, with references, giving full particulars of qualifications and experience, P7174, The Engineer Office. P7174 A

CONSTRUCTIONAL STEEL WORK.—Well-known North Country Firm of Constructional Engineers REQUIRE the SERVICES of a REPRESENTATIVE for London and Home Counties. Applicants must be conversant with the trade and hold a connection amongst architects and engineers. Position is progressive for the right man.—Address, giving full particulars of age, past experience, and salary required, 5287, The Engineer Office. 5287 A

ESTIMATOR.—Reliable ESTIMATOR ENGINEER REQUIRED to Take Charge of Estimate Office by London Firm manufacturing Brewery and Chemical Plant, Steam Pans, Mixers, Condensers, &c.
Permanent and progressive position to suitable man.
State fully age, experience, and salary.
Address, P7177, The Engineer Office. P7177 A

GEARING.—Experienced MAN REQUIRED to Take Charge of Department engaged in the Technical Design and Sale of Cut Gearing of all kinds. Applicants should have theoretical and practical knowledge of gearing combined with proved sales ability.—Apply, SALES MANAGER, Alfred Herbert, Ltd., Coventry. 5265 A

HEAD of a Large Ironworks in the Midlands REQUIRES ASSISTANT. Public school man and university graduate preferred. Age 30-40. Thorough practical knowledge of Foundry and Constructional Steel Plate Work. Tact, initiative and good standing in the industry essential. Salary £800 p.a.—Address applications, which will be regarded as confidential, 5276, The Engineer Office. 5276 A

INDIA.—REQUIRED by British Firm of Engineers, DRAUGHTSMAN, accustomed to Roof, Bridge and Structural Steel Work, able to work out stresses and prepare designs, estimates and detail drawings; must be a bachelor, age 22 to 25.—Apply, stating age and particulars of experience, to Z.M. 189, care Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 5238 A

MANCHESTER ENGINEERING FIRM (About 200 employees) REQUIRE ONE or MORE YOUNG ASSISTANTS to act as Sales Estimators and possibly Assistants in London office later. Public School men essential; age 20/23; sound general engineering training necessary; practical electrical knowledge desirable. State age, education, experience, and starting salary.—Address, 5282, The Engineer Office. 5282 A

FACTORY MANAGER FOR PERMANENT POST IN GREAT BRITAIN.
Age 30-36. Education: B.Sc. standard.
At least four years' experience in managerial work with a progressive manufacturing company is necessary. Present salary should approximate £1000 per year.
Candidates in replying should give details of past experience, &c., and be in a position to supply highest personal references.
Address, P7192, The Engineer Office. P7192 A

HARBOUR ENGINEER.
WANTED, PRACTICAL ENGINEER, age about 40, experienced Construction Reinforced Concrete Jetties with direct native labour; and Maintenance of Works, Plant and Equipment for Harbour in Venezuela. Must have had similar harbour experience and be accustomed to making of Underwater Inspections. Knowledge Spanish and Good Medical Record essential. Progressive position after probationary period of twelve months.—Address full particulars, training, experience, salary required and copies testimonials, to P7191, The Engineer Office. P7191 A

LEASE OF IMPOSING OFFICES FOR SALE.
33, NORFOLK STREET, STRAND, W.C. 2.

In consequence of the recent amalgamation of "THE ENGINEER" LTD., proprietors of "The Engineer," with MORGAN BROS. (PUBLISHERS) LTD., proprietors of "The Ironmonger" and "The Chemist & Druggist," the offices of the three journals have now been transferred to new and more commodious freehold premises which have been acquired at 28-31, Essex Street, Strand, W.C. 2.

The remainder of the lease, covering a further twenty-five years, of the present offices of "The Engineer" at 33, Norfolk Street, Strand, W.C. 2, is in consequence for sale. This particularly well lighted five-storey building has an area of 8,200 sq. ft., and occupies a site at the corner of Norfolk and Howard Streets, adjacent to the Temple Station, whence Westminster and the City may be reached in a few minutes. The building is of modern construction and has a fine and distinctive elevation. It is in good order throughout, and vacant possession can now be had. Rent £1,600. Moderate price. For further particulars apply to:—

WHATLEY, HILL & CO.,
24, Ryder Street, St. James', S.W. 1.

LEASE OF IMPORTANT CITY OFFICES FOR SALE.
42, CANNON STREET, E.C. 4.

In consequence of the recent amalgamation of Messrs. MORGAN BROTHERS (PUBLISHERS) LTD., proprietors of "THE IRONMONGER" and "THE CHEMIST AND DRUGGIST," with THE ENGINEER, LTD., proprietors of "THE ENGINEER," the offices of the three journals have been moved to new and more commodious freehold premises which have been acquired at 28-31, Essex-street, Strand, W.C. 2.
The lease of the entire premises, of which the four well-lighted upper floors have been in occupation of Morgan Brothers (Publishers) Ltd., the Ground Floor and Basement being sub-let to the Aerated Bread Co., Ltd., is in consequence for sale.
Alternatively, the four upper floors (which have also an entrance to Garlick Hill), having a total area of about 7,000 sq. ft. would be let.
The premises are in good order and vacant possession can now be had. Rent £2,000 per annum, inclusive of rates.
For further particulars apply to:
Messrs. FAREBROTHER, ELLIS & CO., 29, Fleet Street, E.C. 4,
or to
HENRY BUTCHER & CO., 63 & 64, Chancery Lane, London, W.C. 2.

SITUATIONS OPEN

SURVEYOR.—REQUIRED IMMEDIATELY by British Company in South-Eastern Europe, ASSISTANT SURVEYOR. Experience in Tacheometer Work essential; good draughtsmanship desirable.—Reply, stating age, experience, &c., and salary expected, to Box 1441, c/o A. W. Brown, 39, Tothill-street. 5271 A

UNIVERSITY GRADUATE, Young and Preferably with some shops experience, REQUIRED as Assistant Engineer to London Firm of Mechanical Engineers.—Address full details experience and education, 5283, The Engineer Office. 5283 A

WANTED, JUNIOR DRAUGHTSMAN for Consulting Engineer's Office in Westminster. Steel Work and General Civil Engineering experience essential. State salary.—Address, 5259, The Engineer Office. 5259 A

A DRAUGHTSMAN, Having a Good Experience in Constructional Steel Work, is REQUIRED by a Firm in East London. State age, experience, and salary required.—Address, P7183, The Engineer Office. P7183 A

DRAUGHTSMAN.—An Experienced MECHANICAL DRAUGHTSMAN, with a sound knowledge of Brewery Works, able to take responsibility for complete contract and work with juniors, REQUIRED by London Firm.
Permanent position. State fully age, experience, and salary.—Address, P7178, The Engineer Office. P7178 A

DRAUGHTSMAN.—An Experienced MECHANICAL DRAUGHTSMAN, with a sound knowledge of Chemical Plant design, including Steam Pans, Stills, Condensers, Mixers, &c., able to take charge and work with juniors, REQUIRED by a London Firm. Permanent position. State fully age, experience, and salary.—Address, P7179, The Engineer Office. P7179 A

DRAUGHTSMAN, Experienced in Design of Trailers and Body Work of all descriptions. State age, experience, and salary required.—Address, 5290, The Engineer Office. 5290 A

DRAUGHTSMAN REQUIRED, Able to Settle dimensions at site, make works details, used to London work.—H. YOUNG and CO., Ltd., Thornycroft House, Smith-square, S.W. 1. 5281 A

DRAUGHTSMAN REQUIRED for Engineering Works in Sumatra; age 22-25, experienced in Structural Design and Factory Layout.—Write, stating experience, to Box 882, c/o Judd's, 47, Gresham-street, London, E.C. 2. 5264 A

DRAUGHTSMAN (Temporary), with Knowledge of Modern Building Construction, WANTED AT ONCE for work in London by large firm of Contractors.—Write, stating age, experience, and salary required, to Box 748, c/o Dawson's, 31, Craven-street, W.C. 2. 5279 A

LEADING DRAUGHTSMAN WANTED for Structural Steel Work. One who is competent to Take Charge of Contracts from the inquiry stage.—Address, stating age, experience, and salary required, to NORTONS (TIVIDALE), Ltd., Hecla Works, Tividale, Tipton. 5275 A

TWO DRAUGHTSMEN (Temporary) REQUIRED IMMEDIATELY in Provinces for detailing Steel Work, Elevators and Conveyors. State salary and when at liberty.—Address, 5274, The Engineer Office. 5274 A

SITUATIONS WANTED

ADVERTISER SEEKS POST; Exp. Gen. Eng., automobile, railway, constructional works and contractors, home and abroad. Wide exp. in responsible positions. Disengaged Aug. 1st.—Address, P7167, The Engineer Office. P7167 B

SITUATIONS WANTED (continued)

ABILITY: Proven and Above Average, Administrative, executive, business, engineering. Undoubted capacity.
QUALIFICATIONS: Mech. and Civil Engineer, wide experience in positions of considerable responsibility, home and abroad, construction, railway, transport, works and factory operation, costing, sales, commerce, mature judgment, energy, disciplinarian, personality, highest character, has made good under difficult conditions, speaks Spanish, Portuguese.
EXPERIENCE: Chief Engineer, General Manager, Director, railways, marine and other transport, engineering works, factories, shipyard, commercial and industrial undertakings. Successful with labour.
ATTAINMENTS: Positions of trust and responsibility, self-confidence, ABILITY TO TURN A LOSS INTO A PROFIT, respect and confidence of employers and subordinates, substantial remuneration, creditable references.
REQUIRES: RESPONSIBLE EMPLOYMENT, home or abroad, irrespective of difficulties or climate.
Address, P7195, The Engineer Office. P7195 B

CIVIL ENGINEER (26), British Subject, Foreign Diploma, perfect French and German, good Spanish, slight Italian, SEEKS POS. where his languages will be useful.—Address, P7193, The Engineer Office. P7193 B

COMPETENT EXECUTIVE, Experienced in the organisation and establishment of industries and works on profitable production basis, DESIRES OFFER; exceptional record.—Address, P7186, The Engineer Office. P7186 B

COMPETENT MECHANICAL DRAUGHTSMAN (28) DESIRES CHANGE, West London area; 8 years D.O., 3 years shops.—Address, P7169, The Engineer Office. P7169 B

ENGINEER and WORKS MANAGER, Very Experienced in reduction of operating expense and labour costs, whilst maintaining and increasing production.—Address, P7056, The Engineer Office. P7056 B

ENGINEER DRAUGHTSMAN, 18 Years' Civil and mechanical experience, factory and plant design, layout, erection and maintenance, used working own initiative and handling men.—Address, P7198, The Engineer Office. P7198 B

ENGINEER.—Experienced Manager and Superintendent (technical and executive), M.I. Mech. E., Extra First Class B.O.T., M.I.N.A., good business acumen and address, desires post—any comparable capacity, or as Representative.—Address, P7182, The Engineer Office. P7182 B

ENGINEER (31) SEEKS CHANGE; Public School education, exp. shops, D.O., asst. eng., works erection, extensions and maintenance, iron and steel works and rubber factory.—BM/L 024, London, W.C.1. P7145 B

MARINE ENGINEER REQUIRES a SHORE SITUATION, home or abroad. Possesses First Class Certificate and Motor Endorsement; 10 years chief in steam, 2½ years chief motor. Re-engagement early August. Highest testimonials.—Address, P7168, The Engineer Office. P7168 B

MARINE ENGINEER, Sailed as Chief for Eleven years, eight with large motor vessels, DESIRES SHORE EMPLOYMENT as Superintendent, Works Maintenance or Construction. Experience with British and Continental types of heavy oil and semi-Diesel engines. Wide experience of auxiliary machinery and plant.—Address, P7139, The Engineer Office. P7139 B

SITUATIONS WANTED (continued)

MECHANICAL ENGINEER (41), A.M.I. Mech. E., with 24 years' experience as works manager, chief draughtsman, &c., in railway repair works, locomotives, general mechanical engineering, plant supervision and layout, pneumatic and hydraulic power operation, pumping plant, &c., estimating, good technical experience, energy and tact, at present in Far East, DESIRES POSITION in ENGLAND.
Address,
P7119, The Engineer Office. P7119 B

METALLURGICAL CHEMIST on Leave from India REQUIRES POST in England; domestic reasons. Formerly at Sheffield steel works for 4 years; 3 years' experience in India.—Reply, BM/FHXS, London, W.C. 1. P7166 B

SPAIN.—ENGINEER (British), Considerable Commercial and selling experience, compressed air machinery, oilfield management, resident Spain 24 years, on vacation, England, July 10th, DESIRES REPRESENTATION, Spain or S. America, for well-established firms. Excellent connections, Government, railways, shipyards, contractors.—Address, P7180, The Engineer Office. P7180 B

STRUCTURAL ENGINEER (34), Competent Designer, with exceptional site experience, DESIRES PROGRESSIVE POSITION.—Address, P7175, The Engineer Office. P7175 B

YOUNG ENGINEER (24), with Thorough Workshop and drawing-office experience in all branches engineering, plant layout, &c., DESIRES progressive POSITION where the services of a really live man is needed.—Address, P7181, The Engineer Office. P7181 B

WORKS MANAGER, Long Experience Light and medium engineering, instruments, statistical, machinery and similar, also electrical products. First-class organiser of production.—Address, P7057, The Engineer Office. P7057 B

YOUNG ENGINEER, B.Sc. Eng. (Lond.), A.C.G.I., 2 years' apprenticeship general engineering, aged 25 years, SEEKS suitable OPENING.—Address, P7190, The Engineer Office. P7190 B

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A Seven-Day Journal

The Channel Tunnel.

THE Government's recent emphatic decision against permitting the construction of the Channel Tunnel is not being taken as the final word in the question. For instance, Sir William Bull, who for many years has been an advocate of the scheme, has issued a pamphlet in which a reply is made to the Government's statement of policy. Among other points made by Sir William is the assertion that the Government's pronouncement misleads the public into believing that the total estimated cost of the tunnel, namely, £30,600,000, would all have to be provided by this country. Actually, says Sir William, not more than half the total would in any case be raised in Great Britain. The argument of the Government that if it licensed the construction of the tunnel it would incur a moral obligation to see the project through is countered by Sir William in a pithy manner. The Government, he says, does not take the least responsibility for the thousands of financial projects which are permitted to be floated in this country, even although parliamentary approval of the schemes is sought and obtained before they are launched. The Government, according to Sir William, would, by licensing the tunnel scheme, assume no more responsibility for it than it does for a bottle of patent medicine when it affixes the revenue stamp on it. From the military point of view the tunnel, Sir William argues, would in war time either be of great value or of negligible value to us—depending upon the circumstances of the war—but it would never be a serious source of danger. From the engineering standpoint, he points out that in the case of no big tunnel so far constructed has there been absolute certainty before work was begun that the project was definitely practicable. He argues that the chances are that any insurmountable difficulty would be revealed when only part of the pilot tunnel had been driven, and that British investors would thereby stand to lose only about £1,250,000 and not the total cost of the whole pilot tunnel, namely, £5,600,000, as suggested by the Government.

Re-opening of St. Paul's Cathedral.

ON Wednesday, their Majesties the King and Queen attended a Thanksgiving Service at St. Paul's in celebration of the completion of the long and difficult work undertaken with a view to the preservation of the structure of the Cathedral. Since March 31st, 1925, all parts of the building except the Nave have been closed to the public in order that the work of repair might proceed without interruption. A sum of nearly £400,000 has been expended on the operations. The work carried out has been frequently referred to in our pages. In the main it has consisted of forcing liquid cement under pressure into the rubble interiors of certain of the piers and buttresses and of binding the drums and cone in the dome structure by means of bars and chains of rustless iron. The fabric, it is claimed, has now been made secure for centuries to come, provided there is no disturbance of the soil around its foundations by deep excavations for new buildings in the neighbourhood.

Edinburgh Electricity Supply.

IN an address delivered a few days ago Mr. Edwin Seddon, manager of the Edinburgh Electricity Department, explained how the undertaking could lower the cost of electricity supplied to the citizens under the Central Scotland Electricity Scheme. Mr. Seddon said that if Edinburgh could first sell all the electricity produced at Portobello to the Board at a price per unit corresponding to the actual cost of production, which would include all capital charges, the Corporation would then buy back from the Board that quantity of electricity required for local consumption at the cost of production plus a proportion of the Central Board's expenses. It might be argued, he said, that as the Board's expenses were added to Edinburgh's cost of production, the Edinburgh public might have to pay a higher rate than that at present charged. What would happen in practice, however, was that instead of the Edinburgh Corporation producing up to, say, 170,000,000 units next year, they would be asked by the Central Board to produce 378,000,000 units, or 122 per cent. more than under the Corporation's own scheme. The effect of the greatly increased output would be to lower the cost of production and the rates, and the saving would be much more than the Board's expenses.

Empire Broadcasting.

THE possibilities and importance of Empire broadcasting could not have been more strikingly indicated than they were a few days ago, when Sir John Simon, speaking from London, through the short-wave experimental broadcasting station at the Marconi Works, Chelmsford, was able to address the people of India on Indian affairs at a time when his words had particular weight and importance. Every word he uttered is said to have been distinctly heard in India and his speech made a great impression. The 5 SW station at Chelmsford has rendered good service to British broadcasting and to the Empire on many previous occasions when special broadcasts from England have been relayed for the benefit of audiences overseas. Reports on the excellence of its transmissions have been received from places as far apart as China and Peru, in addition to South Africa, India, Australia and many European countries in which the station has a regular audience. The station was used for the transmission to the Empire of the thanksgiving service in Westminster Abbey for the King's recovery and for the transmission of the speeches made by the King and the principal national delegates at the opening of the London Naval Conference this year.

Memorial to Sir Henry Segrave.

A COMMITTEE has been formed to promote a scheme for the establishment of a memorial to the late Major Sir Henry Segrave, consisting of a trophy bearing his name and commemorating his achievements, to be awarded every year to the British subject who gives the best demonstration of the possibilities of travel by land, air or water. Those responsible for the proposal state that they have in mind a scheme to encourage the youth of Great Britain to follow after and attain the ideals which Sir Henry had at heart, and to stimulate them to uphold British prestige before the world by demonstrating how courage, initiative, skill and the spirit of adventure can assist progress in mechanical development. The awarding Committee is to consist of the President of the Institution of Mechanical Engineers, the Chairman of the Royal Automobile Club, the Chairman of the Royal Aero Club, the President of the Marine Motoring Association and the Chairman of the Newspaper Proprietors' Association. Lord Brecknock, Westbourne House, W.C. 2, is acting as treasurer for the scheme.

Steel Framed Buildings.

SOME important information concerning the regulations in force concerning the design of steel frames for buildings was elicited recently in the House of Commons by Mr. A. M. Samuel from the Minister of Health. Mr. Samuel asked the Minister whether his Department laid down any regulations as to the loads to which steel frames in buildings might be subjected, whether he was aware that steel frames were allowed by some local authorities to carry loads or stresses which were prohibited by other local authorities for the same quality, strength and design of frames, and whether he would recommend local authorities to adopt uniform regulations in the matter. Mr. Greenwood, in reply, stated that outside London the use of steel framing in almost all the large urban centres was subject only to a by-law requiring due stability and proper construction. The practice of local authorities was, he added, being investigated by the Department of Scientific and Industrial Research, and he proposed in the light of that investigation to consider suggesting to local authorities some working guide as a means of deciding what was necessary to secure due stability. Mr. Samuel further asked whether the Minister of Health would arrange for the Steel Frame Act of 1909 to be examined by scientific authorities for the purpose of revising its provisions rendered obsolete by the improvements effected in steel making since 1909. Building regulations under the Act were, he stated, now so out of date that local authorities frequently waived them. Mr. Greenwood, in reply, said that the Act of 1909 was a London County Council Act and applied only to London. It rested with the County Council to propose to Parliament any measure for bringing it up to date. The County Council had express power in the Act of 1909 and in the Act of 1923 to waive its requirements so far as they related to iron and steel construction. He was in communication, he added, with the County Council on the subject.

Fog Flying Experiments.

IN recent years a number of experiments have been carried out, notably in the United States, in order to develop ways in which aeroplanes might be landed on a fog-covered aerodrome. The first attempts were made in clear weather by covering the pilot's cockpit with a hood and carrying an auxiliary pilot unhooded for safety's sake. The machine was landed by the hooded pilot, who controlled the machine solely in response to instrument indications designed to bring the machine safely down to the aerodrome despite the lack of any visual assistance. A step forward in this investigation was made last week, when a pilot of the Royal Air Force, carrying one of the Air Ministry Scientific Research Staff as a passenger and flying in a standard "Avro" aeroplane, made a succession of five successful landings at Farnborough through a real fog which rose to a height of 90ft. above the ground. The apparatus used was of the simplest character. It consisted of a small tethered sighting balloon 400ft. above the ground and about half a mile from the aerodrome, a pitch and yaw indicator on the dashboard, and a weight suspended by wire a few feet below the landing carriage of the aeroplane. The aeroplane left the ground and flew through the fog until it got into clear air above. It then made use of the known height and position of the balloon to return to the aerodrome, gliding past the balloon at an angle indicated by the instruments and landing on the surface of the aerodrome by means of the indications given to the pilot by the lighting up of a red lamp on the dashboard at the moment when the suspended weight touched the ground. The test was entirely successful and the pilot reported no difficulty. The machine took off again and carried out an exact repetition of the first trial. This also was successful. Thereupon three further similar experiments were carried out, making in all five take-offs and five landings. It is considered that these experiments indicate a real advance in the technique of fog landing, and the method is one which it is expected will be of great practical use.

An East-to-West Atlantic Flight.

FOR the second time the Atlantic has been successfully crossed by aeroplane in the east to west direction. On Tuesday, June 24th, Captain Kingsford Smith, an Australian airman, and three companions left Portmarnock, near Dublin, in the aeroplane "Southern Cross" at 4.25 a.m. After a flight lasting 30 hours 28 min., they alighted at Harbour Grace, Newfoundland, at 10.53 a.m. (B.S.T.) on Wednesday, June 25th. Up to a hundred miles from Newfoundland the weather was fairly favourable. The last portion of the journey was, however, severely hampered by fog. For six hours the machine flew over Newfoundland seeking to land. That it succeeded in doing so successfully is, it would appear, to be attributed to the excellent service rendered by the wireless equipment with which the machine was provided. It is reported that the compasses of the "Southern Cross" gave great trouble off Newfoundland. Details of their misbehaviour have not as yet been supplied, but the particulars will be closely studied when they are received. It has been surmised for some time that an unknown cause, probably associated with the compasses, has been the origin of the numerous disappearances of Atlantic fliers in the past. The aeroplane "Southern Cross" already has to its credit a flight from San Francisco to Brisbane in 1928, a non-stop flight across Australia, two flights across the Tasman Sea, and, in 1929, a record flight of thirteen days from Australia to England. In all these flights Captain Kingsford Smith was the pilot. The "Southern Cross" is a Fokker monoplane, and is driven by three Wright "Whirlwind" engines.

The 1930 Naval Programme.

ON Wednesday evening the First Lord of the Admiralty announced in the House of Commons details of the Government's naval construction programme for 1930. The vessels to be built are three 6in. gun cruisers of about 6500 tons each, one leader and eight destroyers, three submarines, four sloops, one net layer, and one target-towing vessel. The ships, Mr. Alexander remarked, were required to replace others which were about to reach their age limit and were not being built with relation to the programme of any other Power. The programme, he added, would involve a total expenditure of about £9,000,000 spread over three years. One cruiser, one submarine and eight destroyers are to be built by contract.

Continental Iron and Steel Trade Conditions.

YESTERDAY (Thursday) a White Paper was issued containing the report of a delegation appointed by the Economic Advisory Council to inquire into the conditions of the continental iron and steel trades. The delegates consisted of a representative of British iron and steel manufacturers, a representative of the workers employed in the industry, and two Ministry of Labour officials. They visited France, Belgium, Luxemburg, Germany and Czechoslovakia. They report that in each of these countries the wages paid are considerably lower than in this country, and that the hours worked are longer. The plant in use, they state, has been modernised, with the result that the number of hands employed at each unit has been reduced to the lowest limit possible. The delegation found that everywhere the workers were keen and industrious and that the relationships between them and the managements were good. In France, Belgium and Luxemburg there was no unemployment, and in Czechoslovakia there was little, but in Germany 14 per cent. of the workers in the industry were idle and 16 per cent. more were on short time. In none of the countries visited, except Germany, was the effectiveness of the workers' organisation comparable with what it is in Great Britain. In conjunction with this report some figures issued by the National Federation of Iron and Steel Manufacturers are of much interest. It is shown that, after making allowance for the difference in hours worked, for every 100 shillings paid in wages in the British iron and steel industry the German industry pays 67 shillings, the French 50 shillings, the Luxemburg 49 shillings, the Belgian 47 shillings, and the Czechoslovakian 42 shillings.

The Automatic Stabilisation of Ships.

No. XIII. (*Conclusion*).

As means for the automatic stabilisation of ships alternative to either the water tank or gyroscope system, attention may be directed to two proposals of recent years. The first to which we shall refer was advanced in 1928 by Monsieur Deparis in a communication submitted to L'Association Technique Maritime et Aéronautique. Monsieur Deparis' proposal rests on the fact that the torque generated at the propellers of a vessel—the propulsion torque—is accompanied by an equal and opposite reaction torque on the hull of the ship. If in a single-screw vessel the propeller rotates clockwise, as seen from a point aft of it, then the reaction torque will be equal and opposite to the propeller torque, and will heel the vessel to port. The angle of heel acquired will be such that the righting moment corresponding to it will be just equal to the propeller torque. If the vessel has twin screws running in opposite directions, the two reaction torques will balance each other, and the vessel will not heel. Monsieur Deparis' proposal consisted of varying the reaction torque in such a way as to provide a stabilising couple.

The suggestion is attractive in so far as it would result in the stabilising couple being provided by the main engines without the use of additional equipment other than that employed for controlling the reaction torque. It is, however, open to criticism on two principal grounds. In a single-screw steamer, the reaction torque might, by a suitable means of controlling the speed of the main engines, be varied from some maximum value down to substantially zero. It could not, however, be reversed in direction without reversing the direction of rotation of the engines. Hence the stabilising couple would, of necessity, always act in the same direction. It might be possible to apply by this method a stabilising moment which would act to oppose a portwise or a starboardwise heeling moment, but the system could not be made to oppose a heeling moment acting alternately in both directions, as does the heeling moment contributed by a train of waves. The stabilisation therefore could at the most be only partial. In a twin-screw vessel, however, if the propellers run in opposite directions the reaction torque could, theoretically at least, be varied from a maximum in one direction through zero to a maximum in the opposite direction.

In the second place, the proposal is open to criticism on the ground that the stabilising couple would, in general, be deficient in amount. For example, let us consider a vessel having a displacement of 2500 tons, a metacentric height of 12in., engines of 5000 horse-power, and a propeller speed of 200 r.p.m. The mean reaction torque corresponding to full power would be about 58 tons feet. It would be sufficient fully to stabilise the vessel on a train of waves having a length from crest to crest of 200ft., if the height from crest to trough did not exceed 18in.

Various other objections to the system are obvious, but as it has not, so far as we know, been applied in practice, we need not stop to discuss them.

The second proposal of recent years is of Japanese origin, and was advanced in 1923 by Dr. Motora, of the Mitsubishi Nagasaki Shipyard. According to recent information, it has been applied so far to three vessels, a small coastal service passenger ship, a cross-channel steamer belonging to the Imperial Government Railways, and a mine-sweeper of the Japanese Navy.

The Motora stabilising system makes use of fins projecting from the side of the hull at about the turn of the bilge. The equipment provided for the coasting steamer "Mutsu Maru," is illustrated in Fig. 45. Its position on the ship and the amount of space occupied by it are indicated in Fig. 46. The fins are in the nature of lateral rudders, and both as regards their arrangement and action may be likened to the ailerons of an aeroplane. They are capable of being turned about an axis offset relatively to their centre line after the manner adopted in a balanced rudder. The power required to turn them is supplied by an ordinary steering engine, the valves of which are controlled through an electrical relay system by a gyroscope arranged with its spinning axis athwartship. The controlling details are so designed that, as the ship rolls, the leading edge of the fin on the side of immersion rises, while the leading edge of the fin on the emersion side descends. The forward velocity of the ship causes the water to exert an upward force on the fin which has tilted up on the immersion side and a downward force on the fin which has tilted down on the emersion side. A couple is therefore created which acts to restore the vessel to an even keel. As she recovers, the fins return to their normal position, and as she heels over to the opposite side they reverse their tilt.

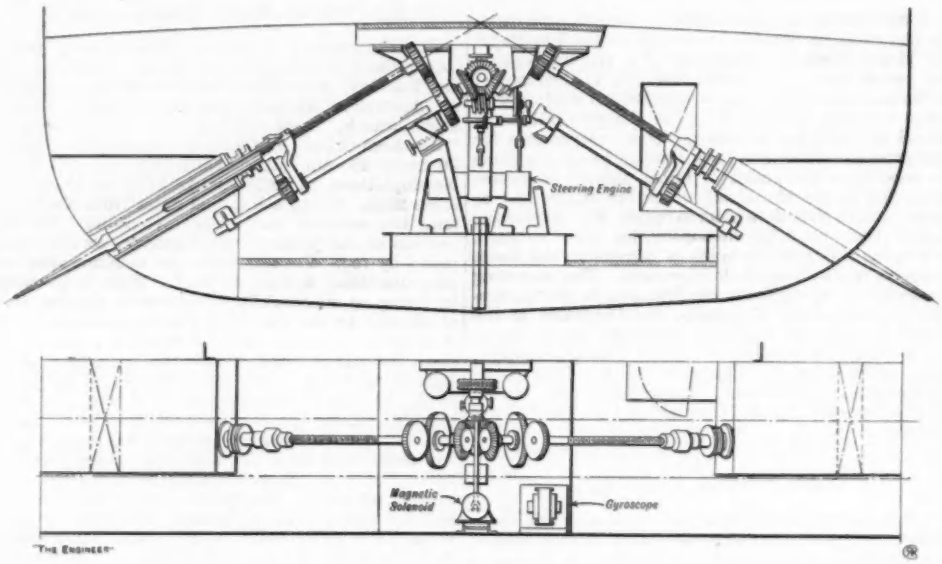


FIG. 45—THE MOTORA STABILISING SYSTEM

The fins when their stabilising action is not required can be retracted within recesses constructed inside the hull. In this way the manœuvring of the vessel in a restricted passage is facilitated, and on a voyage in calm weather she can be relieved of the resistance to longitudinal motion created by the fins.

The most obvious criticism which can be urged against this system is that the stabilising couple derived from the fins must depend for its magnitude in a very marked degree on the forward velocity of the ship. Unlike the water tank and the gyroscope systems, it is incapable of preventing or reducing the rolling of the ship when she is not moving under her own power. It may be said perhaps that it is not very essential to stabilise a vessel when she is in harbour or at anchor. It should, however, be remembered that from the point of view of safety, as distinct from comfort, &c., the automatic stabilisation of ships has a claim to consideration in that it provides a safeguard against capsizing should the main engines break down and the vessel fall into the trough of the sea. In such an event the Motora system would fail to provide any stabilising force except that derived from the action of the fins as bilge keels. Their "aerodynamic" effect would disappear.

The lift of an aerofoil is proportional to the square of its velocity relatively to the fluid through which it is moving. At low speeds the lift is slight, and as the speed increases the lift rises rapidly. It is evident, therefore, that if the Motora stabilising fins are designed to supply the requisite stabilising couple at the designed or normal speed of the vessel, their action will rapidly become deficient as the ship's speed is decreased. This variation of the stabilising couple would not be a serious disadvantage in vessels running for a large part of each trip at a substantially constant speed. In warships and other vessels which have to manœuvre at various speeds, the dependence of the stabilising couple on the forward velocity of the ship might be deemed objectionable. The difficulty could be overcome to a certain extent perhaps by the provision of means whereby the angle of tilting of the fins could be controlled, the maximum angle of the movement being increased as the speed of the ship became less. The lift of an aerofoil increases with the angle of tilt up to a certain limit, beyond which it begins to fall off. It is evident, therefore, that a limit exists to the extent to which the effect of speed on the stabilising couple provided by the Motora system could be compensated by varying the maximum angle of tilt of the fins. So far as is known, no means of varying the tilt is actually employed, although the necessity for some such control has not been overlooked.

It is of interest to note that model tests have shown that if the angle of tilt of the fins is large, an irregular vibratory motion of the vessel may be set up. This phenomenon is doubtlessly to be ascribed to the movement of the fins through and beyond the limiting angle at which the hydro-dynamic "lift" ceases to increase.

It is clear that if a vessel fitted with the "Motora" system as we have described it is subjected to the rolling action of waves while going astern, the fins will cease to function as stabilisers, and will, in fact, act to increase the rolling forces of the waves. For astern running it therefore appears desirable either to dispense with stabilisation altogether or to reverse the tilting motion of the fins.

The danger of damage being done to the projecting fins by floating objects or otherwise need not be dwelt upon. It is partially at least avoided by the provision of means for retracting the fins within the hull. As regards the added resistance to propulsion represented by the fins, criticism should proceed cautiously. In calm weather the fins can be withdrawn, in which case they add nothing to the propulsive resistance, or they can be left projecting and inoperative. In that case the resistance which they offer to propulsion is stated—and no doubt justifiably—to be much less than that which would be created by equivalent bilge keels. When the vessel rolls and the fins take up their tilting motion, the stabilising "lift" of the fins is accompanied by a "drag" and therefore the propulsive resistance is increased. It has to be remembered, however, that the propulsive resistance is considerably increased when a vessel rolls, and, therefore, that if the rolling can by any means be reduced an economy will be effected in the power required to propel the ship. The "drag" of the fins of the Motora stabiliser can consequently be set against the economy of power realised as the result of the reduction of the rolling which they achieve. It is claimed in this connection that, allowing for the lesser rolling, the propulsive resistance in rough weather is increased to a smaller degree when the vessel is fitted with fins than it would be if her hull were naked or if she were fitted with bilge keels instead of fins.

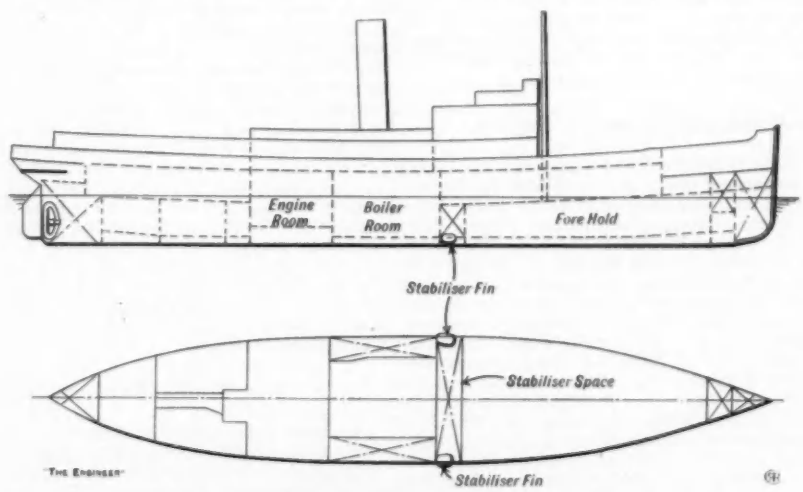


FIG. 46—MOTORA SYSTEM ON S.S. "MUTSU MARU"

The s.s. "Mutsu Maru" to which the Motora system was first applied had a length of 160ft., a breadth of 27ft., a mean draught of about 8ft., and a displacement of 590 tons. Her fins measured 3ft. 5in. in length and 3ft. 2in. in width, and each had an area of 10½ square feet. The maximum angle to

* No. XII. appeared June 20th.

which the fins were tilted was 18 deg. The ship had a natural rolling period of about 10 seconds, but the engine operating the fins was capable of turning them from the horizontal to the fully tilted position in about half a second. It will therefore be gathered that no attempt was made to build up the stabilising couple progressively, but that it was caused to reach its full value almost at once, and to disappear and reverse its direction quickly. The engine was fitted with clutches, whereby it could be used either to tilt the fins or withdraw them within the hull recesses.

In a rough sea, records were taken of the rolling of the vessel when steaming at about 11 knots. With the stabiliser off she was found to roll through a mean amplitude, out-to-out, of 12 deg., with a maximum of 27 deg. When the stabiliser was brought into action the mean value of the rolling amplitude fell to 3 deg. with a maximum of 15 deg. The total weight of the equipment was just under 4 tons—excluding the structural modifications of the hull—or about two-thirds of 1 per cent. of the displacement. The power required to drive the gyroscope controlling the action of the equipment was about 370 watts, and the power spent in the solenoids and electrical relays operating the valves of the engine about 670 watts. The consumption of steam in the steering engine connected to the fins was not measured, but is stated to have been small. As compared with a gyroscopic stabiliser, the cost of the installation is claimed to be quite small, amounting to about one-fifth or one-seventh.

Montreal Harbour Bridge.

No. II. (*conclusion*).*

Erection.

The problems connected with the erection of the main span were unusual and differed considerably on the north and south sides of the channel. Tentative erection plans were developed during the preparation of the tender and were subjected to prolonged study. The methods finally adopted adhered closely to the preliminary plans. The adopted programme required operations to be begun on the north half early in 1927 and on the south half during 1928.

The first outstanding problem was the method of erection to be employed on the respective anchor arms, ground conditions being entirely different in the two cases. The north anchor arm spans the main railway tracks of the harbour and Canadian Pacific Railway. The only ground available for construction purposes was a strip about 100ft. wide between the main pier and the railway tracks. The existing conditions entirely prohibited the use of falsework under the greater portion of the anchor arm.

The south anchor arm is over the river but clear of the navigation channel, the current being approximately 7 miles per hour. Under mean summer conditions, the water is about 3ft. in depth at the south anchor pier, increasing gradually to about 12ft. at mid-span, and then deepening rapidly to about 40ft. at the main pier. The river bottom in this section consists of a shallow layer of hardpan over irregular rock. The river usually freezes at this point in early January and is subject to intermittent ice shoves during the winter. The break-up occurs during late March or early April, and causes ice jams in the vicinity, which often build up to a height exceeding 30ft. at the site and overrun the dock walls. Tremendous pressure is exerted as these jams slowly break up, re-form, and finally move down the river. The water level rises with great rapidity during this period, drops to more normal conditions after the ice movement is completed, and gradually falls a further 6ft. or 7ft. after May, commencing to rise again in the late autumn. It was obvious that no falsework could endure the ice movement unless supported above it on massive foundations.

It was apparent that on the north anchor arm falsework was practicable under the three panels adjacent to the main pier only, it being necessary, therefore, to erect the remainder as a cantilever. These conditions required that a main point of support be established three panels north of the main pier. A re-arrangement of the harbour tracks under the anchor arm made possible the location and construction of suitable foundations, and a steel tower was therefore determined on for that point, as providing, in conjunction with the main pier, a satisfactory base for the support of the superstructure.

In the case of the south anchor arm, methods which might make possible its complete erection in a self-supporting condition in one season, thus avoiding the ice problem, were first examined. It was the final consensus of opinion, however, that the possibility of such an accomplishment was too slight to justify the hazard, particularly as the work would be in serious jeopardy should labour troubles arise. The use of massive foundations for falsework was also discarded as lacking economy, and it was decided to provide a temporary span the full length of the anchor arm, supported at each end directly by the piers. As a further step it was decided to make use of a portion of this span on the north side between the main pier and the steel tower. The resultant advantages were more positive support for the anchor arm during the early stages of erection and much less interference with handling operations on the ground where space was only too limited.

The second major problem was the type of handling equipment to be employed in the erection of the various parts of the structure. The weight of the members varied up to a maximum of 45 tons, but the greater proportion of the pieces to be handled were comparatively light. It was therefore important to provide speedy handling equipment for the lighter material, combined with the capacity for the heavier pieces. At the main piers the trusses are 162ft. in depth, the height of the highest point above the floor being about 160ft., exclusive of the light ornamental finials. This height diminishes rapidly panel by panel on either side of the main post, the greater portion of the span length being within the reach of equipment of reasonable proportions operating on the deck. After a comparison of various methods for the erection of the high portions adjacent to the main piers it was decided to adhere to the original plan of a tower traveller, operating between the trusses on the deck. In the plan of operations finally developed the tower traveller erected these high portions, consisting of four panels of each anchor arm and five panels of each cantilever arm, the remainder of the structures being erected with deck travellers.

The peculiar conditions under the north anchor arm presented some difficulty. The distance from the ground to the top of the main pier is 134ft., and to the floor at this point 150ft., these heights precluding erection at floor level from the ground. After consideration of many schemes it was decided to erect on the ground outside each truss a movable timber tower carrying on its top a heavy derrick. These derricks erected a falsework span and tower; placed the shoes, bottom chords, laterals and floor system from the main pier to the point three panels north of the main pier; assisted in erecting the tower traveller on the deck; and throughout the first season handled all the materials from the ground to the deck of the bridge. This arrangement permitted the erection of the temporary span on comparatively light timber falsework and eliminated the need of pile footings.

The distance between the trusses of the span made possible a convenient arrangement of traveller and service tracks, the latter being laid on the lines of the tramway stringers at 50ft. 6in. centres. For the former two standard-gauge tracks at 24ft. centres, carried in each case on two lines of longitudinal roadway stringers which were reinforced where necessary for the traveller loads, were adopted. The traveller tracks consisted of 85 lb. rails carried on 8in. by 10in. ties 10ft. long, spaced as necessary for the loads to be carried. By restricting the overall width of the travellers to within 40ft. the service tracks were at all times clear, which enabled material to be placed alongside each traveller as required, within the convenient reach of the booms.

Rapid construction required that erection be commenced on the south anchor arm before the equipment on the north side could be released, and the materials to be handled were entirely beyond the capacity of the equipment used on the south approach. The early stages on the south side being much more conveniently served by a deck traveller, that on the north side was duplicated for the south and operations planned on the basis that the single tower traveller would erect the similar sections of the superstructure on both sides. By erecting the cantilever arm concurrently with the rear portion of the anchor arm on the south side as on the north, operations were accelerated and a more economical design for the falsework span made possible. The two deck travellers being thus available, concurrent erection toward the centre from both sides was provided for, as the work approached the final stage.

The final and outstanding problem was the connection of the two cantilever arms over the centre of the channel. This central section of the channel span functions in the completed structure as a simple span suspended between the ends of two cantilever arms. The members CUO-8U2 and CL2-SLO—see Fig. 1—are subordinate, the former being entirely redundant and the latter affected only by wind and traction influences. During erection, however, each half of the suspended span became temporarily a prolongation of the corresponding cantilever arm, the stresses in its chords being of a reverse nature to those in the completed structure. The sub-chords referred to above became integral parts of the top and bottom chord systems and were subjected to heavy erection stresses which governed their design. The closure consisted of the bringing together of the arms at the centre of the span, the making of all connections at that point, and the subsequent transition of the suspended span from the cantilever to the simple span condition under fully controlled adjustment, during which process the stresses in the structure assumed their final nature, those in the sub-chords disappearing entirely.

Early consideration was given to the truss design of the suspended span to determine that arrangement of panels which would give the most favourable conditions at the centre while making the closure. The design as finally adopted contains seven main panels, of which the central panel is bisected by the

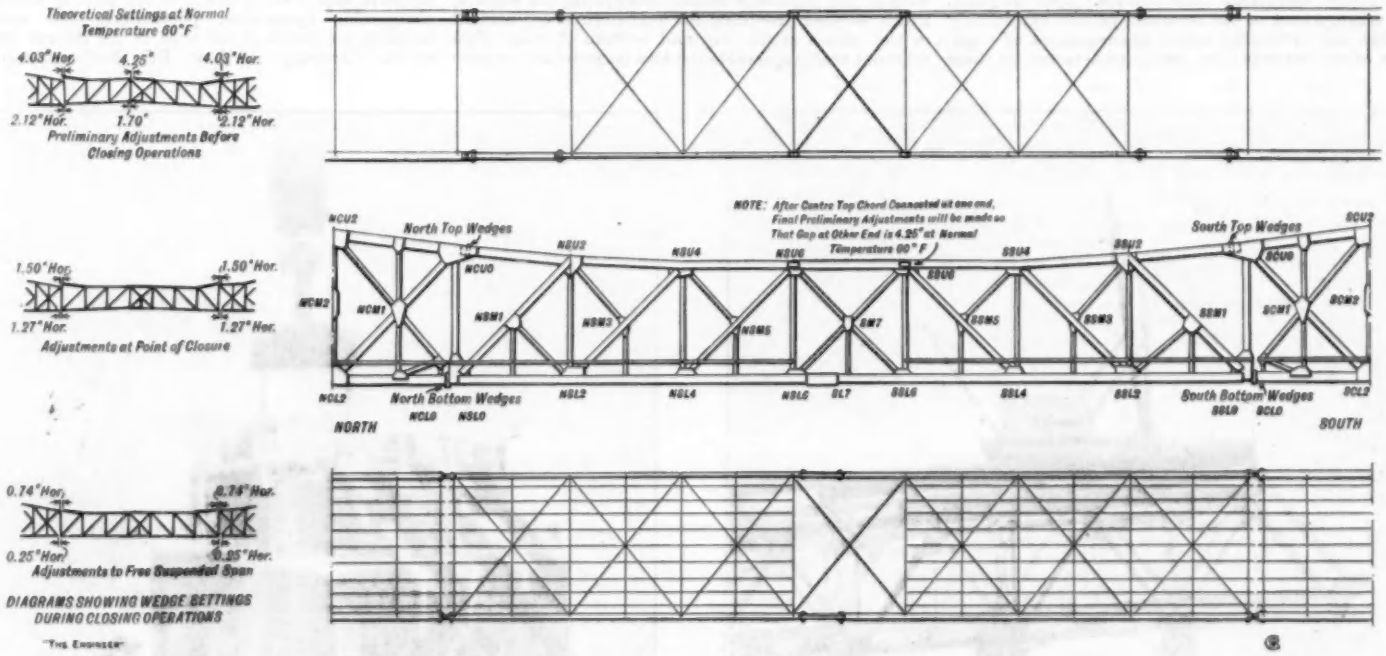


FIG. 1—ARRANGEMENT OF SUSPENDED SPAN

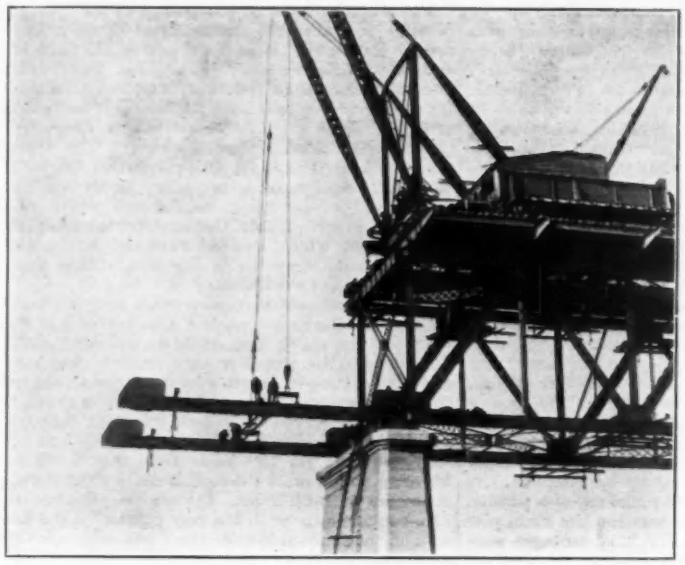
* No. I. appeared June 20th.

centre of the span. The members involved in the closure are indicated in Fig. 1 and consist of top chords and laterals NSU6–SSU6, bottom chords and laterals NSL6–SL7, and corresponding sub-diagonals. The top chords NSU6–SSU6 were designed with butt joints at the panel points, the ends being chamfered slightly at each flange to ensure the bearing being taken on the central portion of the webs. The bottom chords NSL6–SL7 were pin-connected at either end, the holes being slotted 3in. back of the pins to provide ample clearance for the driving of the pins before the closure of the connections and for movement during the closure operations after the pins were in place. The arrangement of the members proved exceedingly flexible and prevented minor discrepancies of alignment in either plane from being bothersome, as these were readily connected as soon as contact at the joints had been established.

In the cantilevered condition the weight of the suspended span and erection equipment produced much heavier stresses in the anchor and cantilever arms proper than was the case after the change to the simple span condition, the stresses in the chords at the outer end of the cantilever arms being up to their safe capacity. The deflections of the arms at this time were sufficient to render impossible the placing and connecting of the final members at the centre without compensating adjustments. Expansion and contraction in the structure, due to temperature changes, also produced a continually varying condition at the centre between the two arms, and it was important that the centre joints should not close prematurely under temperature expansion, as the resultant arch action in the suspended span with consequent thrust against the main piers would have been objectionable, if not serious, under extreme conditions. It was therefore necessary that each half of the suspended span be erected in such a manner that adequate clearances would exist between the ends of the two arms before attempting the closure, which implied providing for longitudinal adjustment in the planes of the top and bottom chords. This required that adjustable devices be provided in each plane capable of being operated under a load of approximately 800 tons on each, and after the consideration of many types, wedge mechanisms were finally adopted for each plane as the means whereby all the adjustments incidental to the closure would be made.

The wedge mechanisms were arranged in the subchords at each end of the suspended span in the positions most convenient for operating; those in the bottom plane being adjacent to SLO and in the top plane to CUO, as shown in Fig. 1. Manual operation was provided for as being most dependable and subject to perfect control. It was also considered both unnecessary and impracticable to design the wedge mechanisms for operation against their maximum load, and they were therefore designed for slacking off only under full load. This necessitated an initial setting of the wedge mechanisms when first placed which would provide sufficient clearances at the centre for every contingency, all adjustments thereafter being in the nature of slacking off.

Before proceeding with the design of the mechanisms all the governing conditions were carefully reviewed and a study made of the data available on comparable operations, particularly the erection methods employed in the case of the Beaver Bridge of the Pittsburg and Lake Erie Railway over the Ohio River in the United States, in 1910. Although the mechanisms as finally designed are similar in many respects to those used in the bottom chords of the Beaver Bridge notable differences exist, particularly in the method of operating and in the use of wedges rather than toggles in the plane of the top chords. The loads to be carried were also considerably greater in the case of this structure and the range of movement to be provided for, very much so. It was a basic principle that the mechanisms be self-locking under load, as uncontrolled slippage would have pre-



FIGS. 2 AND 3—SOUTH APPROACH—CANTILEVER ERECTION OF 245FT. SPAN, FIRST AND SECOND STAGES

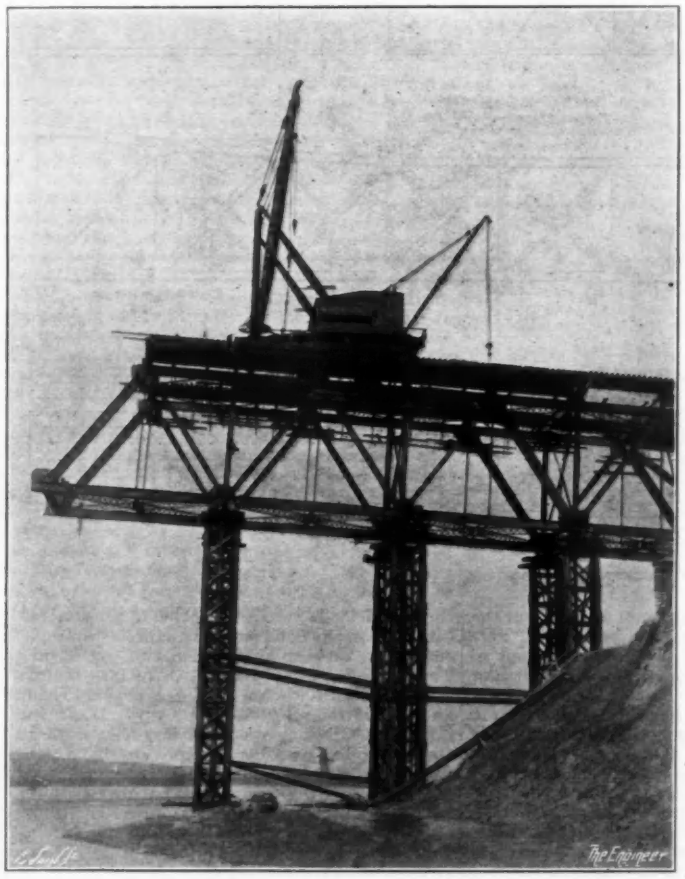


FIG. 4—SOUTH APPROACH—TIMBER FALSEWORK UNDER SPAN NO. 22

FIG. 5—MAIN SPAN, SOUTH SIDE—SETTING SHOE ON PIER

cipitated a disaster. It was desirable, however, to ensure the utmost ease of operation and singularly little data was available as to friction coefficients under the conditions in question. The design was purposely very conservative in view of the importance of the operations, safety being the paramount consideration.

It was essential that the closure operations be planned and conducted with extreme care, not only to ensure geometrical accuracy in making the centre connections, but also to guard against an uneven distribution of loading which, if sufficiently pronounced, might have produced serious stresses in different parts of the structure or in the wedge mechanisms themselves.

Erection Falsework.

North Anchor Arm.—The falsework for the north anchor arm consisted of a steel tower and a temporary span supported at its ends by the tower and main pier respectively, the span being a section of the long span provided for use the following season on the south side, with a few modifications at the end to be supported by the tower. It was originally intended to use pile foundations under the tower, but during the construction of the north main pier it was established that no suitable bearing stratum existed above rock, some 70ft. below ground level. It was also found that old wharf construction had previously been filled over in close proximity to the site of the tower, possibly presenting obstacles to the driving of piles. Pronounced settlements at the tower, particularly if unequal, were to be avoided, and stable construction was decided upon.

Accordingly, two reinforced concrete caissons were sunk by the pneumatic process, and carried down to rock about 80ft. below ground level. The caissons were 12ft. in diameter and consisted of a steel working chamber on top of which the concrete cylinder was built, stage by stage, as the working chamber was sunk. A shaft 3ft. in diameter was provided in the centre of each caisson with a combination man and material lock at the top. Four 2¼in. diameter anchor bolts were built into the caissons to stay the tower and the tops of the caissons were bush-hammered to a true surface at the proper level.

The tower consisted of two steel posts at 66ft. 6in. centres, connected by substantial sway bracing. Each post was made up of two built webs, 36in. wide, spaced 5ft. apart, and connected by heavy lacing. The posts rested on planed steel slabs, 4in. thick, which were set on the caissons on several layers of heavy canvas freshly coated with red lead. Each post was spliced in three sections with butt joints, the upper section being provided with large gussets for the connections to the falsework span. The posts were bored at the top for 15in. diameter pins, which engaged temporary shoes bolted to the underside of the bottom chords, and were designed to transmit the load from the anchor arm to the tower. After a review of the various conditions of loading on the tower an arbitrary maximum was adopted, provision being made for the weight of the structure and erection equipment, together with a 30 lb. wind pressure. Under the assumed conditions, the resultant maximum load on the top of each caisson was 1500 tons, and they were designed for that load. Silicon steel was used throughout the posts and in part of the bracing, the balance being of special carbon steel.

The temporary span was connected to the top of the tower by pins of 11in. diameter, independent pins connecting the chords and end diagonals to the post gussets. At the main pier end the span was supported on rollers in recesses provided in the pier during construction. This end of the span was temporarily secured at the pier until the connection of the bottom chords to the tower had been made, after which it was released, the tower thereafter being braced from the main pier by the bottom chord and lateral system. The connection of the tower to the bottom chords was so arranged as to average the bending stresses due to temperature changes and varying deflections in the structure as erection progressed. Pedestals with jacking girders were provided at the main panel points for the temporary support of the upper structure.

South Anchor Arm.—The falsework for the south anchor arm consisted of a temporary span, 402ft. long between bearings and supported at its ends by the main and anchor piers respectively. It appeared unlikely that this span could be adapted for commercial use afterwards, and it was therefore designed solely for convenience and economy during erection. It was necessary to provide ample clearance between the top chord of the span and bottom chord of the bridge to permit blocking and jacking under the panel points of the anchor arm. A pedestal was developed for the support of the main points with jacking girders incorporated, the difference in the chord widths being provided for in the pedestal design and the arrangement necessitating a uniform clear distance between the chords 4ft. 9in. The design of the piers limited the position of the recesses for the support of the span to that selected, hereby governing the shape of the end panels. The depth of the trusses was chosen for economy, a portion of the bottom chord being made horizontal to facilitate its support during the erection of the span itself.

The span was provided with top laterals and sway bracing, but bottom laterals were omitted; it was assumed that the overturning effect of the wind pressure on the span would partially offset that on the anchor arm and the traveller. Methods were devised for making use of the permanent floor system in temporary position on the span during its erection, as the cost of an independent floor would have been excessive. The materials required for the span was thus limited to the trusses, top laterals, and bracing.

As previously outlined, the method of erecting the superstructure consisted in setting up four panels of the anchor arm with the tower traveller, followed by concurrent erection of the cantilever arm with the tower traveller and the rear portion of the anchor arm with a deck traveller. A complete schedule of operations was developed, a feature of which was that each anchor arm truss would have a single main point of support at all stages, this point being transferred backwards from the main pier panel as erection progressed. This method of support required somewhat heavier material in the span than would have been necessary if the anchor arm had been left supported at each panel point. The uncertainty as to the weight distribution in the latter case would, however, have prevented full advantage being taken of the theoretical economy. The method adopted was much the safer, and very much more simple and expeditious in operation.

The loads on the span were calculated for the various stages and the span designed accordingly, provision being made for the weight of the structure and erection equipment, together with a 30 lb. wind pressure. Silicon steel was used throughout the trusses, and

*FIG. 6—NORTH APPROACH, TYPICAL METHOD OF ERECTION

in part of the bracing, the balance being of special carbon steel. The members were of standard design, the chords being 42in. in depth with two webs 28in. apart and with butt joints.

The erection of the temporary span was in itself a work of some importance. It was necessary to commence at the south anchor pier, and after a study of the river bottom conditions, it was decided to erect the first portion of the span on falsework and cantilever the remainder to the main pier, this necessitating a main point of support near the mid-span in the form of a tower. This tower support was placed at a point distant 212ft. from the main pier—see Fig. 6, page 714.

As the maximum load to be carried on the tower during the erection of the span was 1230 tons per truss, use was made of a steel tower composed of the lower two sections from the tower as used on the north side with special caps on the tops of the posts. These caps were designed to permit the span being jacked at that point during the process of landing on the main pier. The top of the tower was braced to the span by horizontal pin-connected struts extending from the top of each post to brackets on the underside of each truss. The magnitude of the erection stresses in the span required reinforcement in the trusses and bracing over the tower, which was provided.

To provide adequate foundations for the tower, two circular piers were built under the respective trusses. Steel cylinders 12ft. in diameter were sunk to the bottom and anchored to protective cribs. The hardpan bottoms within the cylinders were shattered with explosives and cleared by clamshelling, after which the bottoms were sealed with sandbags by a diver. Concrete to a thickness of about 3ft. was then deposited under water, after the setting of which the upper shells were pumped dry and the remaining concrete poured to the desired level, anchor bolts being set at the same time. The tops of the piers were treated in the same manner as at the caissons on the north side. This work was executed for the contractor by Quinlan, Robertson and Janin, Ltd., of Montreal, contractors for the superstructure south of St. Helen's Island.

The timber falsework under the temporary span was of the same general type of construction as used for the south approach. It was erected on low concrete pedestals which had been constructed the previous autumn. The temporary span was placed on fixed bearings at the main pier to reduce to a minimum any difference in longitudinal movement at the points of support, due to temperature variations or changing deflections. At the anchor pier the span was carried on rollers, this end being secured against movement during the erection of the span and released after its completion. Possible uplift at the anchor piers during erection of the span was provided for by blocking the ends in the recesses to engage the weight of the pier and by additional weight on the span adjacent to the pier.

The World Power Conference at Berlin.

No. II.*

THE formal technical meetings of the Conference commenced on Monday, June 16th. To make the work of the Conference at all manageable, the papers were classified, as we have already indicated, into thirty-four groups or sections, according to their subject matter. Prior to the Conference a summary of the contents of each group had been prepared by an official reporter, and it was this summary which alone was read and formed the basis of the discussion on the group of papers concerned. Thus, in thirty-four meetings, it was possible to dispose of the whole of the papers. Usually three meetings were held simultaneously, but even so, some thirty hours had to be allotted to discussions. Since it would require just about two pages of THE ENGINEER to print merely the titles of the four hundred odd papers submitted, and the names of their authors, the impossibility of giving anything like a full report of the proceedings in the space at our disposal will be obvious. We shall have, therefore, to confine our attention to those sections likely to be of special interest to our readers, omitting all reference to many sections and papers which we might otherwise have dealt with.

World Problems on Power Economics.

Under this title Dipl. Ing. F. zur Nedden summarised eight papers, dealing with subjects ranging from the development of power from the Arctic seas to the maintenance of power supply in the case of labour troubles. The chairman of the meeting was Mr. C. H. Merz. Our readers will be familiar with the recent proposals of certain French engineers to develop power by taking advantage of the temperature difference between surface water and deep sea water in the tropical oceans as we have more than once referred critically to the scheme. The idea brought before the Conference was to make use of the temperature difference between the winter air in the Arctic and that of the water under the ice sheet. The latter cannot vary appreciably from zero Centigrade, whereas the air temperature may be very considerably lower. The power would be developed in "steam" turbines, the working substance being a hydrocarbon of low boiling point, such as Propane or Butane, evaporated by the heat in the sea water and condensed by a brine solution at —22 deg. Cent. The author, Dr. H. Barjot, also a Frenchman, claimed that a plant working on these lines producing power at less than 1·5d. per kWh could be built and operated commercially, for the use in the ore mines of the extreme North. It is comfortable to turn from this scheme to consider, as Herr Meguscher did in another paper, the exploitation of waste heat from geysers and hot springs. This author, however, sees no prospect of commercial success for such exploitation, geysers being too intermittent, and hot springs being generally too heavily charged with minerals. Imagination of another kind is shown in a paper by three Norwegian engineers, Messrs. B. Stuevold-Hansen, J. Kinck and A. Norstrand. They go into the technical and legal conditions relating to a possible power line to export electricity from Norway to Germany *viâ* Denmark. It is estimated that an overhead line 620 miles in length, working at 380 kV and having a transmission capacity of 750,000 kW, could supply Lubeck at a cost of £4·75 per kW-year. The cost of the project, including the power station, is estimated at £35,000,000. As an alternative, power might be exported *viâ* Sweden, through a 110-kV submarine cable from Trelleborg to Sassnitz, supposing that such a cable could be constructed. With increased concentration of power supply, the effect of strikes of power station workers become of more and more importance. Both Germany and England have had certain experiences since the war, and in Germany the trade unions have discountenanced strikes in power plants and a number of agreements have been made for emergency service in such conditions. There

* No. I. appeared June 20th.

is also a voluntary organisation of technical experts in Berlin, which can be mobilised by the Government whenever its services may be necessary in the public interest.

Power Supply on Ships.

In this section, as might be expected, British authors predominated, Great Britain having to be credited with four out of the seven papers which were presented. The chair at the meeting was appropriately taken by Sir Charles Parsons, and the general reporter for the section was Ministerialrat W. Laudahn. Three of the papers dealt with oil engines, the other four being concerned with steam turbines, boilers, systems of boiler firing, electrical propulsion and the design and performance of auxiliary machinery. Special attention was paid to the use of high-pressure steam at sea, this subject forming the basis of a paper presented by Sir Charles Parsons, Mr. R. J. Walker, and Mr. Stanley S. Cook. These authors emphasised the advantages which were to be derived from the use of higher steam pressures and temperatures. The greater the pressure the higher the average temperature at which the heat enters the working fluid, so that the theoretical conditions for efficiency are improved by increasing the pressure. The theoretical aspect was discussed at some length, and it was shown that high-pressure steam up to and even beyond 1000 lb. per square inch undoubtedly presented possibilities of increased working efficiency. Although a working pressure of 1000 lb. per square inch was used by Loftus Perkins as early as 1824, it was not until quite recently that working pressures higher than 200 lb. per square inch were used in British mercantile ships and 275 lb. per square inch in water-tube boilers for naval service. The adoption of higher working pressures in land installations in Britain, America, and in Europe had influenced marine practice. The first modern high-pressure steam installation aboard a ship was that of the Clyde turbine steamer "King George V.," the turbines of which were built for a working pressure of 500 lb. per square inch and a steam temperature of 750 deg. Fah. The success of the "King George V." had influenced the building of larger high-pressure steam installations for liners of the Canadian Pacific "Duchess" and "Empress" classes. In these ships a series of three turbines grouped around a common gear wheel transmitting power to the propeller shaft was used. That type of drive enabled turbines of an efficient and robust type to be employed. The excellent results of the "Duchess of Bedford," with her 0·57 lb. of oil per S.H.P. hour for the main and auxiliary engines, including the steering gear, were referred to, and a layout of a quadruple-screw turbine installation with 160,000 S.H.P. output, operating at a steam pressure of 600 lb. per square inch and 750 deg. Fah. total temperature, was given; with it an overall oil fuel consumption of 0·54 lb. per S.H.P. hour would be obtained. The authors foresaw an oil consumption even less than 0·5 lb. for an installation which would embody in it all the latest improvements in auxiliary plant and stage feed heating. With such a fuel consumption the high-pressure steam plant was considered by the authors to provide the cheapest form of marine propulsion.

In the first part of the German review of marine engineering progress, presented by Professor Krainer and Dipl.-Ing. Zeuner, reference was made to the pioneering work of German engineers in this particular field. In this connection mention was made of the Schmidt superheater and the water-tube boiler, the Lentz valve gear, and the Bauer-Wach exhaust turbine system. Installations of high-pressure water-tube boilers, sprinkler type stokers and powdered fuel for marine use had also been built and were under test. The machinery of the new North German Lloyd liners "Bremen" and "Europa," the re-engined ship "Columbus," belonging to the same owners, and the four liners of the Hamburg-Amerika "Albert Ballin" class, were singled out as marking noteworthy advances. Special reference to the Schmidt high-pressure boiler and the balanced draught arrangements on the "Albert Ballin" and other boilers was made by Director Hartmann, who commented on the success of these plants, including 60 atmospheres and 100 atmospheres pressure boilers, some of which would be visited by members of the Conference. Another speaker instanced the good results obtained with the Loeffler system on locomotives, and advocated the use of the Loeffler boiler with its indirect system of heating for marine work, whilst others referred to savings to be effected by the reheating of steam by exhaust gases and the general need to pay more attention to the design and operation of auxiliary plant was stressed. In this connection the paper of Monsieur M. H. Brillié, dealing with certain developments which have been perfected on the steamers of the Compagnie Général Transatlantique may be mentioned. Monsieur Brillié referred particularly to improvements in oil and coal firing, the design of steam supply pipes, stage feed heating and the special method of thorough lubrication, associated with his own name, which had, he stated, improved the mechanical efficiency of ships' machinery by as much as 7 to 8 per cent.

Among other supporters of steam, Herr Wagner put in a plea for more study of the means of saving weight and space in steam plants, which, if done, would enable them to compete successfully with Diesel engines. By good design and the use of special metals, he had hopes that the high-speed steam turbine might be ultimately employed for aircraft work. For large units such as 16,000 B.H.P. turbines, he looked forward in the future to weights of the order of 6 kilos. per horse-power and a fuel consumption of 0·35 kilos. to 0·3 kilos. of fuel per horse-power hour.

A paper presented by Rear-Admiral W. M. Whayman, was mainly concerned with the progress made in recent years both in England and America in the firing of Babcock and Wilcox water-tube boilers with pulverised fuel and the fitting of mechanical stokers to Babcock and other types of marine boilers. Reference was made to the results obtained on cargo vessels of the Canadian Pacific Steamships, Ltd., and the Royal Packet Navigation Company of Holland, with mechanical stokers and tests of various types of pulverising mills were given. Arrangements are well advanced for the carrying out of large scale experimental work with a pulverised fuel installation fitted to a modern high-pressure water-tube boiler at the Babcock and Wilcox Renfrew works.

Turning to the oil engine papers we may first mention Dr. A. L. Mellanby's able review of the present position of the heavy-oil engine industry in Great Britain. In 1929, he pointed out, 159 motor ships, of 785,921 gross tons, were classified by Lloyd's Register of Shipping, out of which 71 motor ships, aggregating 333,976 tons, were built in Great Britain, while at the present time 101 motor ships of a total gross tonnage of 651,975 are under construction in Great Britain and Northern Ireland. The author paid tribute to the work of the Marine Oil Engine Trials Committee, and went on to enumerate the different types of oil engine now being built in Great Britain. These he summarised under the "Harland B & W" type, the "Sulzer" type, the "Doxford" type, the "Scott-Still" type, the "Vickers" type, the "North Eastern-Werkspoor" type, and the new "Richardsons-Westgarth" two-stroke double-acting type. As Herr Willnecker remarked in the discussion, in recent years the tendency in all countries had been towards the construction of an increasing number of two-stroke engines, several important builders of four-stroke engines having lately interested themselves in two-stroke designs. A study of Dr. Mellanby's paper shows that the prevailing type in Great Britain remains the four-stroke pattern, a natural consequence, we would remark, of the want of enterprise in new developments. It is to be hoped that the good example set by Mr. W. S. Burn in evolving his own type of engine may be emulated by those tempted to take the easy, but unprofitable, path of dependence on foreign designs. Mr. Burn's own paper dealt with the trend of design of double-acting, two-stroke oil engines. He traced the rapid development of this pattern of engine since 1928, and mentioned the gradual increase in mechanical efficiency which had now attained a figure of the order of 85 to 87 per cent., while the very low fuel consumption of 0·36 lb. to 0·37 lb. of oil per B.H.P.-hour had been achieved. There followed an interesting comparison of the different cylinder and bed-plate constructions for the principal British and continental engine types, and the questions of airless injection and scavenging were treated in some detail. The author, in dealing with probable future developments, instanced the almost universal application of the two-stroke, double-acting principle, which was now being utilised for units developing from 500 B.H.P. up to 25,000 B.H.P. The reductions in cost, weight and size, which the latest supercharged designs made possible, indicated an important future for the higher speed types, especially for peak load service in power stations. A point made in the discussion by Mr. M. Gercke was the possibility of utilising heavier oil fuels at sea. Some of these fuels, he said, were now being successfully used in South American motor vessels.

A paper presented in this section by Mr. Richard W. Allen contained a very full consideration of the present position of the auxiliary generating engines and dynamos for ships' use. The details given mainly referred to the Allen four-stroke single-acting design, which had been successfully adopted in British and foreign motor vessels. A German paper dealing with oil engines, which was written by Professor Rembold, sketched the principal lines of advance in Germany. In 1929 there were no less than fifty-two ships equipped with double-acting two-stroke engines of German design, with a total output of 30,400 S.H.P. Of these, seventeen ships aggregating 107,000 B.H.P. were for the Hamburg-Amerika Line. The reporter inclined to the view that consumptions of 0·175 kilos. per B.H.P., which have been attained in the Hennigsdorf peak load plant, and even 0·165 kilos. per B.H.P. might be looked upon as a possible figure for large plants. With such a consumption the probable thermal efficiency would be 38·3 per cent., or much higher than that of steam plant. The further development of two-stroke high-speed motors with gearing, when required, was advocated. It seemed desirable to utilise the heat of the cooling water in ships' installations as well as that from the exhaust gases, and several speakers in the discussion made reference to possible savings in that direction. In Central Europe the design of oil engines for river steamers and canal service had been developed recently, and in this connection an Austrian paper by Ing. L. Roesler gave some particulars of motor-driven tugs and their use on the Danube. Particulars of new triple-screw tugs were given and tests were referred to as showing that on the Danube there is a saving of ·15 per cent. per ton-kilometre in favour of the motor tug. Some speakers made reference to similar tugs in service on the Rhine and contrasted their performance with steam tugs, maintaining that the latter showed better results.

Almost the only reference to the extended use of electricity for main propelling and auxiliary service was made in a section of a German paper by Dr. Stauch on electrical power on ships. The author dealt with the varied application of electric current for deck auxiliaries and engine-room purposes, and was of the opinion that the future of the electric drive was still a matter of dispute in view of its high cost and the weight of the plant. It only found application in special types of ships. Speaking on this subject, Herr Krell made the point that in pressing forward with electrical solutions the wish might often be father to the thought. He instanced the supercession of excellent designs of hydraulic machinery by motor-driven plant largely on the ground of fashion, and pleaded for a dispassionate consideration of the problems.

Sir Charles Parsons closed a long discussion with a strong plea for the objective treatment of the problems in question and the necessity for the continued development of the various systems without undue rivalry.

Individual Problems of Power Supply in Different Countries.

The ten papers which were grouped into a section under the above title dealt rather with statistics of work actually accomplished and with estimates for the future, than with matters which appeared more worthy of the name of "problems." They were summarised in a report by Dr. Ing. Adolf and discussed under the chairmanship of Signor Lodispoto. The countries the progress or prospects of which were reviewed were the Argentine Republic, Lithuania, Russia, Japan, Canada, and the United States. During the discussion, the Italian position with regard to electrification was explained and further data were given, particularly by Dr. F. A. Gaby, the Chief Engineer of the Hydro Electric Commission, with regard to the organisation and development of water power in Canada. The story from every country was the same. The demand for electricity was continuously and rapidly increasing, with no indication that the saturation limit was being approached. Central stations were becoming larger and larger and national "grid" systems of interconnection were being developed in various countries. Russia was, as is well known, engaged on a five-year scheme of electrification which would terminate in 1933. By that time it is anticipated that the total annual output of electricity will be 26,000 million kWh, of which 73 per cent. will be generated by a group of State power stations. The aggregate installed capacity of these State power stations is to be 5,300,000 kW, out of the 7,700,000 kW of generating plant in the country. The length of the E.H.T. lines, from 20 to 220 kV pressure, will be 16,000 kiloms., and 82 per cent. of the total industrial power of Russia will be supplied by electricity in 1933. Data given in two other papers dealing with Russia made it appear as if these estimates were likely to be fulfilled, as at the end of last year 2,586,500 kW of new power stations were under construction. The annual increase of consumption is about 22 per cent., attaining 6465 million kWh in 1928–29, and during the same year the aggregate length of E.H.T. lines was increased to 3378 kiloms. Moscow and district are to be encircled by a high-tension ring main of 115 kV fed from the five power stations of the Moges-Union and from the new State super-station of 150,000 kW and supplying the city by means of six large sub-stations. The super-station is to be constructed on the lignite fields near Moscow. Turning to another country, not very dissimilar in climatic and geographical conditions, but above suspicion where facts and figures are concerned, the Conference heard some striking statistics from Mr. Gaby. There were now, he said, in Eastern Canada some 300 miles of 220-kW transmission lines, 1150 miles of 110-kV lines, and 1200 miles of lines working at pressures between 12 and 90 kV. All these were main trunk circuits and were additional to the 10,000 miles of rural lines working at pressures from 4 to 12 kV. Interconnection of systems had given excellent results, the load factor being improved and the costs lowered. During 1929 the average price to domestic consumers in the Commission's area was only 1·7 cents per kWh. The outages of the transmission lines seemed to be inversely proportional to the voltage, no failure, either electrical or mechanical, having occurred during two years on the 220-kV lines carrying 150,000 H.P. on a single three-phase circuit. In the province of Ontario, where the Commission operates, all installations were inspected by the Commission before they were connected up, and all electrical apparatus had to be approved before being sold to the public.

Further information concerning the same country was given by Mr. John Murphy, the Electrical Engineer to the Canadian Government, who explained the system by which disputes concerning the prejudice caused by transmission lines were avoided. There was in Canada a body called the Board of Railway

Commissioners, who had practically complete jurisdiction, not only over railways, but also over power lines, telegraph lines and telephone lines. Under an Act passed twenty-five years ago no electrical conductor could be erected, maintained or operated across, along or near any other conductor owned or operated by a legally authorised company without the consent of the latter. If no agreement could be come to, the matter was referred to the Railway Commissioners, whose decision is final. The scheme had worked perfectly for the last twenty-five years. From figures given by Mr. J. G. Smith and Professor C. V. Christie it appeared that the known water powers of Canada were estimated to have an aggregate value of 33,617,200 H.P. Of that total 15·16 per cent. had been developed, the average rate of development being 360,000 H.P. per annum for the last five years. By 1934 it was estimated that the total developed capacity would be 7,500,000 H.P. Another country strenuously engaged in developing its water power is Italy, for which some figures were given by Signor Lodis Poto. There are in that country 844 hydro plants with a total installed capacity of 2,910,340 kW, as against 226 steam plants with an aggregate capacity of 645,450 kW. In 1928 the total production of electricity was about 10,000 million kWh, or 258 kWh per head of the population. Of this total less than 12 per cent. was used for lighting, the remainder being absorbed by traction and various industries.

Mechanical Transmission of Power.

Although four of the papers out of the seven comprising this section dealt with the transmission of power in motor vehicles and in factories, the principal discussion was devoted to the joint paper of Professor Dr. Ing. G. Lomonossoff and Professor Dr.-Ing. F. Meineke on the transmission of motive power in locomotives, and Mr. A. E. L. Chorlton's notes on power transmission gears for oil engine locomotives. The report on the section was presented by Professor Dr.-Ing. Kammerer, himself the author of a paper on factory driving, and the chair was taken by Mr. Alan E. L. Chorlton, the vice-chairman of the section. Professor Lomonossoff found himself in general agreement with Mr. Chorlton as to the necessity of a specially designed locomotive type engine with an output of about 400 B.H.P. per cylinder at about 800 r.p.m., which could be constructed as a six-cylinder unit. Such an engine, he contended, if built with a supercharging arrangement, might be conveniently designed for a two-gear transmission with a flexible coupling or clutch. He was of the opinion that any solution of the problem of the heavy-oil engine-driven locomotive involved questions of railway mechanics and also economics. It was only by the joint co-operation of oil engine designers, locomotive builders, railwaymen and electrical engineers that the ideal locomotive would be evolved. Mr. Chorlton's paper, Professor Lomonossoff thought, gave valuable information with regard to the Buenos Aires and Great Southern Railway 1300 B.H.P. "Sulzer" locomotive with hydraulic transmission and the large 2660 B.H.P. locomotive built by William Beardmore for the Canadian National Railways, particularly as to the performance of the last-named locomotive.

Mr. Chorlton gave the further information that the latter locomotive had shown itself capable of drawing goods and passenger trains at speeds of 65 miles per hour, and had run well. Unfortunately, owing to a defective cylinder casing which admitted water to the cylinders and was now being replaced, the locomotive had been out of service for several months. Mr. Chorlton suggested that engines generally similar to those built for the R 101 British airships might be employed for railway work. They were of all-steel design and had run long and successful tests. They had a weight of only 4 kilos. per B.H.P. One of the speakers made reference to the compressed air transmission system in use on the German railway locomotive, while others spoke of the success of smaller locomotives with the electric drive which had been successfully employed in competition with steam locomotives. The importance of accurately cut gears for mechanical transmission, such as the ground gears described by Mr. H. F. L. Orcutt, was generally admitted, while the careful analysis of transmission gears for motor cars, lorries and omnibuses, made by Major E. G. E. Beaumont in another paper, was also a very useful contribution to this section.

An American Meeting.

At a well-attended American meeting which was held in the State Opera House, Mr. F. M. Sackett, the American Ambassador in Berlin, spoke briefly on the great advances which had been made in the use of electricity. In the course of his remarks, he expressed the opinion that as far as he was aware there was only one industry in which the selling price of a commodity was fifteen times that of the cost of its production. In most large American cities, the Ambassador went on to say, consumers were paying 6 cents per kilowatt-hour, or about 15 to 20 times the actual cost of producing the current. That fact, he suggested, offered a wide field for further research work on the part of those engineers who were responsible for the distribution of current. At the close of his address, he read a personal greeting from President Hoover to the members of the World Power Conference, to which a suitable reply was sent. Following the Ambassador's address, Mr. H. Foster Bain, of New York, read a paper on "The Place of Minerals in a Power-controlled World," in which the questions of the distribution and utilisation of the minerals of the world was dealt with in an interesting fashion. The speaker gave two instances of the need for using low-grade ores. About one-third of the copper production of North America was to-day mined from ore containing less than 80 lb. of copper per ton, while in the Alaska-Juneau mine gold ore containing only 87 cents per ton of gold had produced over 4 millions of dollars last year. An encouraging outlook for the future of the world's mineral supply was the large quantity of reclaimed metal. Thus, in 1929, half the steel production of the United States, aggregating some 59 million tons, represented reclaimed scrap metal. Some minerals had been little employed as yet. One of them was silicon, of which there was an abundant supply. In a power-dominated world minerals were needed, but the earth's crust was made of mineral matter and its conversion to man's use was his high privilege and, for him, his great adventure. At the close of this address, part of the Thomas Edison talking film entitled "The Birth of the Incandescent Lamp" was shown.

The Banquet.

The grand banquet which crowned the social side of the Conference was held in the Sportpalast on Wednesday, June 18th. The building, in the form of an oval amphitheatre, was admirably adapted for the purpose, for not only were the 1500 guests comfortably seated, but the central arena gave an opportunity for intercourse before the banquet and later provided an excellent stage for the performers who entertained the guests. This entertainment, sandwiched between the courses, comprised German folk-songs, sung by a choir of 400 schoolgirls; exhibitions of physical culture exercises now so popular in Germany by young men and women, and, most admirable of all, processions and dances by hundreds of performers representing the fifteen different peoples constituting the German nation. All were dressed in their picturesque local costumes, and such a performance was said never to have been given before in Germany. It was a wonderful exhibition, and one not likely soon to be forgotten by those who witnessed it. During the banquet radio communication was established with San Francisco, London and New York, and the guests were able to hear, by means of loud speakers, an address by Mr. Sloan, President of the National Electric Association of America, sent from the annual meeting of the Association in San Francisco. Mr. Owen D. Young, chairman of the General Electric Company of America, also spoke from San Francisco, Mr. Edison said a few words from his laboratory in Orange, New Jersey, while Senatore Marconi and the Earl of Derby, the president of the First World Power Conference, were heard from London. The whole of the proceedings were an unqualified success and reflected the greatest credit on the organisers.

(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

UNEMPLOYMENT.

SIR,—Owing to the spread of education, all nations will, in the future, be in a position to carry on for themselves. Therefore, with the exception of nations having to import raw materials not found in their own country, the foreign markets will almost disappear. And each nation will have to depend on itself. Wages and the hours of labour will then have to be regulated by the law of supply and demand, and, in order to protect the workers, a minimum wage and a maximum number of working hours per week might be adopted.

Talented people, having ambition, will always find a way of getting educated, and it is a great mistake to allow the day schools facilities for teaching pupils vocations instead of imparting general knowledge. After a person had begun an apprenticeship he could select a course of study at an evening technical college which taught technical subjects from the beginning. These remarks indicate that the State is spending too much money on education. Those we are producing are not "assets to the nation" at all. They are a burden on the public. Too much education unfits most people for doing manual work, and besides, we have too many educated people already who are only interested in escaping drudgery. It is about time that we applied the law of supply and demand to this class, when fixing their pay. The intellectual class of people educate themselves for the pleasure of being educated and nothing else.

Keeping children longer at school and compelling the older workers to retire at a certain age will not cure unemployment, as they are all eligible for work and being made idle. In addition, they are a burden on the public. But the real workers will not accept this idea, and labourers will demand the right of rising to the rank of tradesmen for the same reason that tradesmen have for rising to higher vocations.

The attention given to engineering in the daily Press is the cause of it being overcrowded, and it would be better for all concerned if more attention were given to other industries, say, agriculture and the textile industries, and this also benefits the engineering vocations, while those in other vocations have more interest in them than they have in the building of new roads, &c., and in the building of motor cars. But whatever industries may be held up for admiration, it is absurd to encourage people to study for posts in them, and at the same time reduce the number of these posts by forming combines and trusts in the name of economy. Economy at the expense of labour is false economy.

It is not desirable that combatant military officers, &c., should receive the same instruction that is given to those who study for engineering posts. The two vocations are totally different. Combatant officers should only be required to study more or less on the lines required for a M.A. degree, in addition to military subjects, and those engaged in education would benefit. Common sense dictates that departmental engineers should be in charge of the design and manufacture of all mechanical appliances used by the Navy, Army and Air Force, and that only the purely combatant officer be allowed to command those using them.

Shareholders should object to pay directors the princely salary that many of them receive. Their responsibility as a rule is nominal and in the end rests entirely on those under them.

All combines and trusts should be broken up into small limited liability companies, independent of each other, and not be allowed to control more than half a million pounds capital, and all new limited liability companies would require to be within that amount, combines and trusts, &c., to be declared illegal.

No person to be a director of a limited company unless he had served an apprenticeship in some department of that industry carried on by the company. No director to hold more than one post at a time. No director to receive a greater salary than—a maximum one—ten times the pay of a general labourer. Director referred to means a director who holds a situation in the service of the company as a manager. The other directors on the board to be selected from shareholders who hold the largest amount of shares.

The profits made by a limited company should not exceed 7½ per cent. per annum on the original shares, and all profits over this should be used in reducing the prices to the public.

The chief draughtsman engaged by contracting mechanical or electrical engineering firms should be designated the chief engineer of the company, and he should stand in the same position to the board of directors that the municipal engineers stand to the municipal councils. He should not require a figurehead official over him. The management of a manufacturing firm is not engineering, as the firm only exists for trading purposes, and an educated man of grit, having a genial personality and having an all-round experience in the highest branches of commercial subjects in the fullest sense, makes the best chief for a manufacturing firm, as he always looks upon the head technical men as his advisers. Whereas the technical chief too often considers the commercial men his servants.

We should not encourage the making of millionaires. We would be much better off by an increased number of employers, who each had smaller amounts of money. This would give a better distribution of money and more people would be employed. It is the function of a Government to maintain law and order in a country; but it should not be allowed to act as the managers of any industry.

We should not encourage foreign countries to send manufactured articles to our home markets, and we would be showing foresight were we to prohibit the exporting to other countries of coal and minerals. The quantity of these are limited and we will require them later on in the near future for our own use.

State ownership and nationalisation in all forms must be resisted. True progress will be made when we are guided by experience and do not allow ourselves to be forced forward like sheep when we have lost our bearings. When people get lost, they have sense to turn back, if necessary, in order to get on to the right road. Therefore, we should do all that lies in our power to develop a new scheme of private enterprise and, at the same time, let our past experience enable us to develop it on better lines and make it a real success.

Edinburgh, June 16th. CONSERVATIVE.

B.E.S.A. SPECIFICATIONS.

SIDE ENTRY WALL PLUGS AND SOCKETS.

THE British Engineering Standards Association has just issued a specification, No. 372, for Side-entry Wall Plugs and Sockets for Domestic Purposes. This specification is a combination of B.S. Specification No. 73, Two-pin Plugs and Sockets, and B.S. Specification No. 317, Three-pin Plugs and Sockets, both of which it supersedes. The only point in which No. 372 differs appreciably from the superseded specifications is in connection with Clauses 12 and 36 dealing with the provision of a guard or hand shield, these clauses having been broadened somewhat to allow more scope to the designer in providing adequate protection to the hand of the user. The specification gives standard ratings, and tests for current-treating capacity for two-pin and three-pin plugs and sockets of the type used for domestic purposes. Dimensions are given to ensure interchangeability, and stipulations as to the attachment of conductors, &c., are made in order to ensure safety and durability in use.

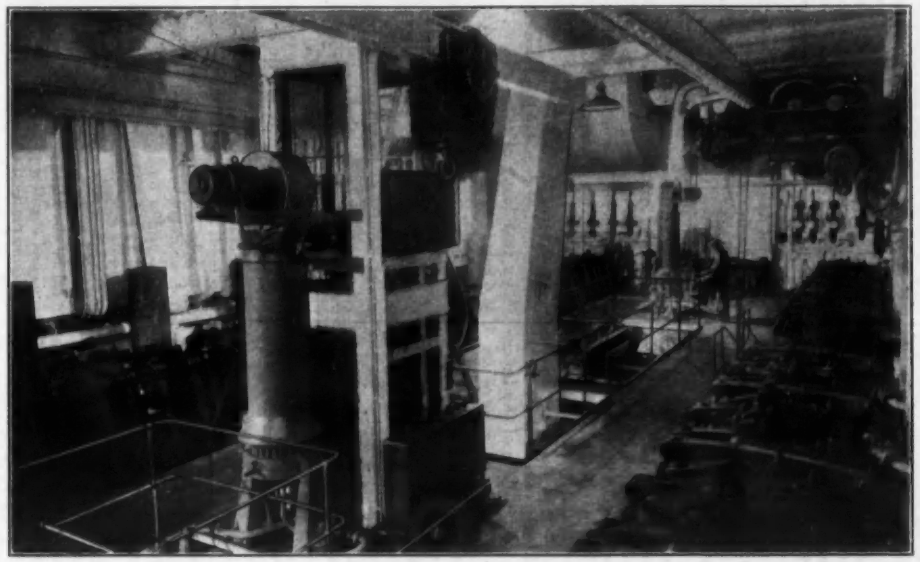
Copies of this B.S. Specification, No. 372—1930, may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

THE WHITE STAR MOTOR LINER "BRITANNIC"

HARLAND AND WOLFF, LTD., BELFAST, BUILDERS AND ENGINEERS

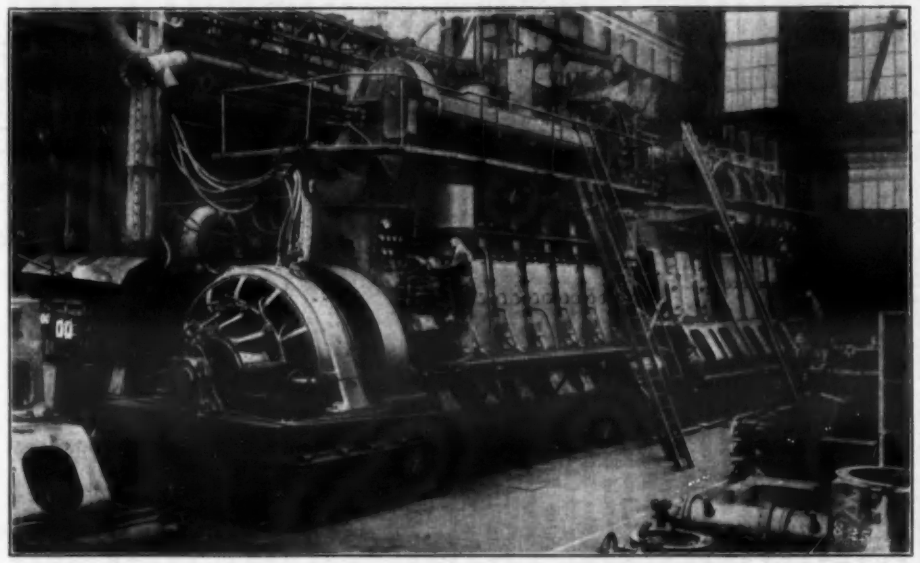
(For description see opposite page.).

STARTING PLATFORM



TOP PLATFORM—ENGINE ROOM

STARBOARD MAIN ENGINES IN WORKS



AUXILIARY ENGINE IN WORKS

THE WHITE STAR MOTOR LINER "BRITANNIC"

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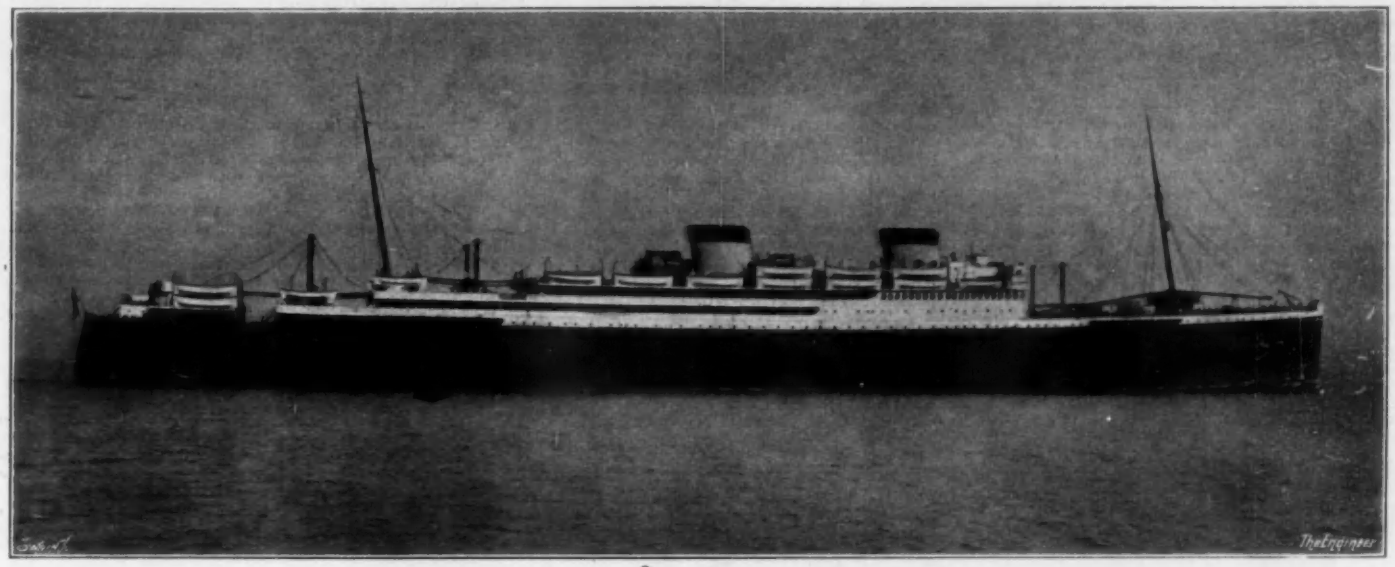

New White Star Motor Passenger Liner "Britannic."

THE new White Star motor passenger liner "Britannic," which arrived at Liverpool early this week, and which sails to-morrow—Saturday, June 28th—on her maiden voyage to New York, bears the distinction of being the largest British motor vessel afloat. Her propelling machinery is also the most powerful unsupercharged oil engine installation which has yet been constructed. She has been specially designed and built by Harland and Wolff, Ltd., at Belfast, for the Liverpool–New York service of her owners and for lengthy cruises. A sister ship is under construction at Belfast, and there is no doubt that these motor liners will mark the arrival of a new and successful type of Atlantic ship, which will once more illustrate the enterprise of their owners. We were recently afforded an opportunity of inspecting the "Britannic" at Belfast shortly after she had completed her official trials on the Skelmorlie measured mile, and we also had the pleasure of making a voyage on her from Belfast to Liverpool. In what follows we give an account of the chief features of technical interest.

THE GENERAL HULL DESIGN.

The "Britannic" has been built in accordance with the highest requirements of Lloyd's special and Board of Trade surveys, she embodies the most up-to-date procedure as regards her safety and navigational equipment, and her handsome appearance may be gathered from the broadside view which we reproduce above. In the table which follows we give the principal hull dimensions and particulars, and also the dimensions and outputs of both the propelling and auxiliary machinery :—

Hull Particulars.

Length overall	712ft.
Length between perpendiculars	680ft.
Breadth moulded	82ft.
Depth moulded to C deck	43ft. 9in.
Height from keel to sun deck	78ft. 9in.
Loaded draught	32ft. 9in.
Designed sea speed	About 15 knots
Gross tonnage	26,943

Passenger Accommodation.

Cabin class passengers	504
Tourist third-class passengers	551
Third-class passengers	498
Total	1,553

Main Propelling Machinery.

Type : Twin-screw, Harland-B. & W., double-acting four-stroke motors.	
Number of cylinders in each engine	Ten
Cylinder bore	840 mm. (33 1/16 in.)
Stroke	1,600 mm. (63in.)
Service revolutions	102 r.p.m.
Designed M.E.P.	About 90 lb./sq. in.
Designed total service output	20,000 S.H.P.

Air Compressor Sets.

Type : Harland-B. & W., four-stroke, single-acting motors.	
Number of units	Four
Number of cylinders each engine	Four
Cylinder bore	550 mm. (21 5/8 in.)
Stroke	1,000 mm. (39 3/8 in.)
Normal running speed	160 r.p.m.
Designed output each set	850 B.H.P.

Auxiliary Generator Sets.

Type : Harland-B. & W., four-stroke, single-acting motors.	
Number of units	Four
Number of cylinders each engine	Six
Cylinder bore	500 mm. (19 11/16 in.)
Stroke	750 mm. (29 1/2 in.)
Normal running speed	160 r.p.m.
Generator output each set	500 kW.
Voltage	220 volts

Emergency Generator Set.

One 75 kW Harland-B. & W. oil engine driven generator.

The "Britannic" is a flush deck ship, with a complete superstructure and a combined bridge and forecastle extending for 403ft. over the length from the stem. There are eight steel decks clear of the machinery spaces, including the sun deck, promenade deck, bridge deck A, upper deck B, main deck C, middle deck D, lower deck, and orlop deck, while at the ends of the ship in Nos. 2, 3, and 8 holds there is a lower orlop deck, making nine decks in all in those sections.

The keel of the ship is a single thickness of 1·08in. plate, with a flat bar 18½in. wide with a thickness of 2½in. The outer hull plating from the keel to the upper turn of the bilge, which has a thickness of 0·94in., was hydraulically riveted, special shallow heads being formed in order to minimise resistance. A cellular bottom with floors on every frame extends out flat to the sides of the ship at a height of 4ft. 9in., giving good protection at the bilges, and it runs from the fore to the after peak bulkheads. In the way of the main engine-room, the depth is increased to 7ft. 6in., and special recesses are provided for the engine crank shafts, the bed-plates being directly bolted to the specially stiffened tank top. Each of the engines is carried on four main girders which are continuous throughout both the main and auxiliary engine-rooms, and are so designed as to give longitudinal strength and rigidity. Between and outside the engine-room spaces the double bottom forms tanks, which are available for fuel oil, fresh water, and ballast water. At B deck level specially strong girders have been worked into the hull structure, to afford strong ties in the region of the machinery openings and to give additional transverse strength. The cargo holds and the outer skin of the ship are strongly built and special provision is made for refrigerated cargo space. At A deck an expansion joint is provided, in order to prevent the transmission of heavy stresses to the lighter members of the superstructure. In the superstructure itself similar provision has been made. The funnels are oval in section, and it may be of interest to state that they extend only 27ft. above the top casing and that their axial dimensions are 32ft. and 27ft. 6in. in the fore and aft and athwartship directions respectively. All the plates, angles and girders for the ship were supplied by Harland and Wolff's allied company, David Colville and Co., Ltd., of Glasgow and Motherwell.

The stern frame, which is built up in four pieces, weighs 30½ tons, and this forging, together with the boss arm castings, was manufactured by the Darlington Forge Company, Ltd. A semi-balanced single-plate rudder is used. It weighs 43 tons, and is supported on a special bearing on the lower deck, which relieves the weight on the two pintles.

The water-tight subdivision of the hull has been designed according to the latest Board of Trade requirements, and there are twelve water-tight transverse bulkheads, which are carried up to C deck and to B deck in the case of the fore peak bulkhead. The water-tight doors are of the Harland and Wolff electrically-operated type, and are controlled from the bridge. The power for their operation is obtained from the auxiliary generator or alternatively from the emergency generator set.

SAFETY AND NAVIGATIONAL EQUIPMENT.

Besides the very thorough water-tight subdivision of the ship above referred to, very complete fire protection devices and extinguishing equipments are provided. The lifeboat installation is worthy of note. It comprises twenty-eight boats, twenty of which are designed to carry eighty-six persons each. Of these boats, eight sets are carried double nested with the remaining four single. The eight other boats include two motor boats with Gardner engines and wireless equipment, each designed to carry forty-five persons, two lifeboats for forty-two persons each, and two for twenty-six persons each. All the boats are carried in Welin-MacLachlan quadrant type davits, and electrically operated boat-hoisting gear, driven by Laurence Scott motors, is provided.

The navigating instruments and the other aids to navigation include an electric submerged log and submarine signalling apparatus, Kent's clear-view screens, Ray's revolution direction indicators, Siemens' helm indicators, and compasses of the latest Sperry gyro Mark VIII. type. The Marconi wireless equipment with the direction finder embodies all the latest improvements, and the two-valve receiver has a wave-length range of from 15 to 20,000 m., there being a single instrument in a cast aluminium case. The main transmitter is designed to signal on 600 m. and 800 m. for continuous waves and interrupted continuous waves and on wave lengths between 1687 m. and 2725 m. on continuous waves only. During the recent trials of the vessel, wireless telephonic communication was maintained between the ship and the builder's offices with satisfactory results. We may add that gyro-compass indications are given on the radio direction finder. It has been found that the accuracy of wireless bearings is greatly increased when they are referred to the gyro-compass instead of being indirectly related to the magnetic compass bearings on the bridge.

Reference at this point may conveniently be made to the steering gear, which is of the Harland and Wolff–Hastie electric-hydraulic type. The main gear, which is housed in a spacious room, was manufactured by the builders, the two pumps designed on the Hele-Shaw-Martineau principle being supplied by Hastie and Co., Ltd., of Greenock. There are four rams working on a double-ended tiller, and the pumps are so arranged that they may be worked either singly or together and started from the engine-room. The 100 B.H.P. motors which drive them are of the Laurence Scott type, and the telemotor gear was built and fitted by MacTaggart Scott, of Edinburgh.

DECK AND AUXILIARY MACHINERY.

For handling cargo there are twelve 3-ton and four 5-ton Laurence Scott electric winches, which work in conjunction with derrick gear. The warping winches, which are also of the electric type, were supplied by Clarke, Chapman and Co., Ltd., of Gateshead-on-Tyne, and operate on the booster system, with Ward-Leonard controls. At the after end of the ship are two warping capstans, by Napier Brothers, of Glasgow, which have the same type of control system and are operated by Laurence Scott motors. In all, there are 300 fathoms of steel link cables, and the bow anchors are of the Dreadnought Hingley type. Other interesting machinery includes the ventilating and heating system, which is of the Winsor Pleno unit type, and was supplied by the Winsor Engineering Company, Ltd., of Pollokshaws, Glasgow. In all, there are forty-two units, designed to deliver up to 14,300 cubic feet of air per minute. The temperature of the air can be varied between 0 deg. Fah. and 80 deg. Fah., and very neat hit-and-miss type of louvres are fitted in the public rooms and cabin spaces. The temperature of the air can be maintained at any desired figure by means of special thermostatic controls. For the ventilation of the engine-rooms, pantries, and galleys, &c., a very complete installation of Sirocco fans by Davidson and Co., Ltd., of Belfast, has been fitted. Six large fans are used for the machinery spaces, and deliver air to them under pressure. Most of the other fans —some thirty-eight in number—are of the exhausting type, and they vary in diameter from 55in. down to 10in., and require over 188 B.H.P. to drive them.

Most of the galley and kitchen equipment is electrically operated. The baking ovens and galleys were manufactured by Henry Wilson and Co., Ltd., of Liverpool, and the kitchen machinery equipment by the Hobart Manufacturing Company, Ltd., of London. There are seven Waygood-Otis electric lifts, including those for the use of the engineers, and for the swimming bath. In order to make the passenger accommodation as quiet as possible, special sound insulating material has been introduced between the engine-room spaces and the adjoining accommodation, and there is heat insulation in the way of the boilers and kitchens. These materials were supplied and fitted by Thomas Anderson and Co., Ltd., of Liverpool. The refrigerating installation was designed and built by J. and E. Hall, Ltd., of Dartford. It serves insulated spaces in the Nos. 2 and 3 'tween decks, having 85,000 cubic feet capacity, as well as ship provision spaces and domestic requirements. There are two large horizontal CO_2 twin-compressor machines, each driven by a 75 B.H.P. variable speed motor. The usual complement of evaporators and brine pumps together with temperature control arrangements is fitted. Part of the space is cooled by cold air and part by brine pipes.

PASSENGER ACCOMMODATION.

A tribute may be paid to the excellent design of the public rooms and the pleasing way in which the English

style of decoration has been carried out by Heaton, Tabb and Co., of Cricklewood. The accommodation has been specially laid out for Atlantic and cruising service, and it is excellent in all the classes.

Main and Auxiliary Propelling Machinery.

The main engines, the auxiliary air compressor sets, and the oil-electric generators are housed in two separate engine-rooms, which are spacious and have allowed the machinery to be laid out to the best advantage. Two views in the engine-rooms are reproduced on page 710. The main engine-room is served by a lift from the engineers' quarters. It is seen in a view which shows the upper platform which gives access to the top cylinder covers and valves. Attention may be called to the overhead cranes, which are equipped for power lifting and for hand travelling. Alongside the main 10-ton cranes there are cantilever beams which, with 2-ton pulley blocks, may be used to lift valves and other small engine parts. Such an arrangement has been found very useful in practice. On the upper platform spare parts are carried, and there are valve-grinding machines by Campbell and Isherwood, Ltd., of Liverpool, and a work bench. The view which we give also shows just in front of the engineers' lift one of the "Stannock" air heaters supplied by Standard Engineering and Pochin, Ltd., of Leicester, which are fitted throughout the machinery spaces. It is of interest to know that the utilisation of the heat in the fuel is so complete, and that the lagging of the exhaust connections so effective that, particularly in winter, it will often be necessary to warm the air in the engine-room. This is done by the steam heaters shown. We may also state that special attention has been devoted to the ventilation of the engine-room spaces, and the tunnel spaces, and a very large supply of fresh air is continually circulated through the engine and boiler-rooms.

The main exhaust pipes are arranged at the forward end of the main engine-room bulkhead, and change-over valves to by-pass the waste heat boilers are provided. The boilers referred to are of the Clarkson thimble tube type. There are four main exhaust gas boilers and one boiler for the auxiliary generator sets. They are designed to work at 100 lb. per square inch, and in service the designed duty is about 10,000 lb. of steam per hour. For ship and harbour use, there are two single-ended Scotch boilers, which are oil fired on the Todd system. They are accommodated in a room between the main and auxiliary engine-rooms. These boilers work at 150 lb. pressure and are complete with their feed pumps and oil fuel plant.

The second platform in the main engine-room gives access to the valve rods, drag links, and cam shafts, and we noted that the links were made from bronze die castings, with adjustable bearings. The fuel valves are furnished with variable lift controls, which, when running slow, alter and reduce the opening of the valve by means of the rotation of the fulcrum shaft. This device is designed to save both injection air and fuel. From the third platform the lower cylinder valves can be inspected, and access is given to the short exhaust outlets connecting the cylinder cover to the water-cooled exhaust manifold.

On page 710 a typical view of the bottom or control platform, with the starting and manœuvring hand wheels and gauges is given. Although for the purpose of the photograph all the wheels were manned, the engines can quite well be attended by two engineers, as the actual movement of the valves is carried out by an air-operated servo-motor. A useful feature to which previous reference has been made is the clear and illuminated space below the control platform, which allows all bedplate bolts to be inspected. At the after end of the engine are the electrically operated turning gears, which are of the worm type, the angled worm engaging with teeth on the fly-wheel face. The fly-wheel is totalled enclosed, and immediately aft are the Michell thrust bearings.

Below a view in one of the propeller shaft tunnels is given, and we may remark on the roomy character of the tunnel and the clear headroom. To ascertain the torque on the driving shafts, Siemens Ford electrical torsion-meters have been provided.

The circulating pumps for fresh water, salt water and lubricating oil are all of the electrically driven vertical type, by W. H. Allen, Son and Co., Ltd., and Drysdales and Co., Ltd. The latter firm also supplied the bilge, ballast and other pumps. In accordance with usual practice, the main pistons are cooled with lubricating oil and fresh water is employed for the cooling of the main cylinder covers and jackets, and the air compressor sets. Other pumps include Allen hot salt water pumps and Weir feed pumps for the exhaust gas boilers, besides fuel oil pumps, &c. There is an auxiliary steam-driven air compressor, and the injection air is stored in two vertical blast bottles arranged on the starting platform, the starting and manœuvring air being contained in two large cylindrical reservoirs, one of which is placed in each of the engine-room wing spaces. Each reservoir has a capacity of 1000 cubic feet, and is charged to a pressure of about 350 lb. per square inch. The lubricating oil system and the cooling water system includes electric alarms of the "Monitor" type, which at once announces any disturbances in the flow.

The four air compressor sets and the four 500 kW generator sets are accommodated in the auxiliary engine-room, and particulars of these units are given in the above table. We noted their very smooth running and total absence of vibration. Indeed, when the ship was berthed, it was difficult to tell whether any auxiliary machinery was working. No doubt this desirable result has been achieved by the choice of a moderate speed with six-cylinder balanced engines for driving the generators, and four-cylinder engine units with twin, three-stage, compressor cylinders, making a six-cylinder arrangement in the case of the air compressor sets. Although two compressor sets will supply all requirements, three will usually be in operation. The switchboard is arranged at the forward end of the engine-room, and comprises seventeen panels, the electrical equipment of the "Britannic" being one of the largest of its kind afloat. The main switchboard is connected to twelve master boards in different parts of the ship, and there are suitable connections to the emergency generating set and the emergency switchboard. The auxiliary engines are complete with their own circulating water and lubricating oil arrangements, and a very complete installation of Sharples super-centrifugal oil purifiers is provided for dealing with the lubricating and fuel oil. For fresh water purification an installation of "Uneek" sand filters, supplied by the "Turnover" Filter Company, of Belfast, are included. The engine-rooms are provided with suitably arranged stores and also large workshops for running repairs. As previously indicated, the spare parts necessary are arranged in convenient positions on the various platforms and bulkheads, so that they are quickly available when required.

In the short description we have given, we have only briefly referred to the outstanding features of a particularly well-planned installation. The design of the main engines is in accordance with standard Harland and Wolff practice, and does not call for special comment. On page 710 we show one of the main units on the test bed in the builder's works, and some idea of the size of the motor can be obtained from this view. Another illustration shows an auxiliary engine and generator in the maker's works.

M.V. "BRITANNIC"—PORT SHAFT TUNNEL

Trial Results.

The official trials of the "Britannic" extended over a period of three days, and included the usual measured mile runs at Skelmorlie in the Firth of Clyde. At all speeds she was shown to be free from vibration, and her general performance was indicative of her capacity to fulfil all the requirements of the service in which she will be engaged, with a handsome margin over her designed service speed. Owing to the fact that her air compressors are separately driven, she was shown to possess excellent manœuvring qualities, which are very necessary for a vessel of her size which must be handled in New York harbour. Even although the engines were put through a long series of consecutive manœuvres, the starting air was maintained at practically a constant pressure.

There is no doubt that the "Britannic" will prove a very popular ship in her service, and the satisfaction of her owners is clearly indicated by their decision to install practically identical propelling and auxiliary machinery in the sister liner now under construction. We would express our indebtedness to the owners and builders in allowing us to examine for ourselves the many interesting features of a new liner, which will be the outstanding vessel of her class completed in the present year, and a further addition to the many famous ships built and engined at Belfast.

SIXTY YEARS AGO.

THE history of our own times would undoubtedly have been greatly different if sixty years ago the advisers of Napoleon III., the tired and irresolute Emperor of the French, had not persuaded him that the only hope of saving his dynasty lay in a successful war. In about a month's time France was to score an isolated and wholly deceptive success over the Prussians in a minor engagement at Sarrebruck. Two months ahead lay Sedan and the end of the Second Empire. These events were still hidden in the future. A wise observer might, nevertheless, have perceived signs of approaching disaster to France. The French armies might be "ready to the last gaiter button," as Court circles asserted, but the general populace was clearly restive under Napoleon's weakened rule. From the pages of our issue of July 1st, 1870, we can gather some sidelights on the condition of France at that critical period of her history. The weather was hot and water was scarce, so scarce that many works were being hampered in their operations, while in Paris watering of the streets had been given up. Tempers rose with the thermometer. All over the country workmen and employers were in dispute and every day the industrial situation was growing in gravity. The Parisian ironfounders had been on strike for some time. They were by now reduced to a deplorable condition and were dependent almost entirely on gratuitous aid. They persisted, however, in their demands and had even increased them. They were now asking 6½f. per day and were declaring that rather than accept lower terms they would leave Paris and even France. The provincial foundry workers refused to execute orders received from Paris, and what little business was being done in castings was passing across the frontier to Belgium. At St. Etienne the founders, fitters, turners and boilermakers had struck on the refusal of the employers to reduce the working hours to 10 per day and to increase overtime rates by 50 per cent. At the Western Railway works at Rennes, the men had gone on strike to secure shorter hours. At Orleans the cabinet makers were idle and at Lyons the masons had ceased work because the employers had refused to grant their "monstrous demand" that every man, whatever his experience and ability, should receive 5f. a day. The Conseils de Prud'hommes, tribunals composed of equal numbers of employers and workmen and charged with the duty of settling trade disputes, were impotent. At Vienne, the founders and machine makers had cited their workmen before the local Conseil for having struck work without giving eight days' notice. They asked for 300f. damages in each case. The Conseil deliberated long and then gave judgment against the men. It was not, however, a unanimous decision. One of the workmen-members immediately resigned from the Conseil and in a few days all his fellows followed his example. The verdict was thereby deprived of its authority and all chance of a friendly settlement disappeared. Napoleon reached his presidency on the shoulders of a workman's revolution. He lost his emperorship in the midst of another.

A SCHEME for electricity supply to villages in the North Riding of Yorkshire between Startforth, on the borders of Durham County, and Norton, near Malton, was recently discussed at a meeting of the Northallerton Rural Council. The scheme has been drawn up by the Cleveland and Durham County Electrical Power Company, which proposes to lay high-voltage overhead cables in part of the Northallerton Council's area. The matter was referred to the Finance Committee, with power to call a special meeting of the Council to consider its report. The scheme provides for generating stations to be erected in the towns of Norton and Northallerton, and from these stations it is hoped to serve all the villages in the area between Startforth and Norton. The scheme is part of the great national plan to supply cheap current and power to rural areas. It is hoped that in the areas where there already is electric light the cost of the current will be reduced from the present high charges, which amount in some cases to as much as 11d. per unit, to the cheaper rates prevailing in larger towns.

Railway and Road Matters.

A NEW station, to serve the Gladstone Dock, was opened on the Liverpool Overhead Railway on June 16th. It is called Gladstone.

THE report by Colonel Trench on the fatal collision of March 6th at Culgaith—London, Midland and Scottish Railway—was issued on June 20th. It is shown that it mainly was due to the passenger train leaving Culgaith when the starting signal was indicating "danger."

THE widespread disorganisation of traffic caused by the abnormal rainfall and consequent flooding of lines on Wednesday, June 18th, calls for mention. An unusual feature was that Kilsby tunnel on the L.M.S. main line east of Rugby was flooded, but the usual alternative route through Northampton was also blocked by a landslip. Trains for London thus had to be taken from Rugby to Market Harborough and then reversed and taken thence over the former Midland main line to St. Pancras.

THE Southern Railway Company is the only one of the four grouped companies to let the hotel and refreshment room business out to contract. That was so with the three companies that formed the Southern Railway under grouping at the beginning of 1923. The contract of the London and South-Western was with Messrs. Spiers and Pond and that firm continued to act for that section and took over some of the other sections. More favourable terms having been offered by other catering firms, the connection with Messrs. Spiers and Pond—which has been in existence for forty years—ends on December 31st next.

To cope with increasing holiday traffic to the West of England, the Great Western Railway proposes to carry out the following programme of improvements:—(*a*) The down platform at Exeter—St. Thomas—is to be lengthened from 400ft. to 620ft.; (*b*) track circuiting is to be installed at Reading, Bristol—Lawrence Hill—and Merthyr, Mardy Junction; (*c*) modern signalling arrangements are to be installed at Barry; (*d*) a sand drag is to be provided at Glyn Neath in order to provide a safer and more expeditious working of coal trains on the Vale of Neath Line; (*e*) certain bridges on the Andoversford Junction–Andover Junction section are to be strengthened, while portions of the permanent way are to be relayed and wider clearances afforded; and (*f*) improved telephone facilities are to be provided between Paddington, Reading, Swindon and Bristol, while to cope with the heavy telegraph business between Paddington and Swindon, a teleprinter—capable of dealing with sixty messages an hour—is to be installed at those stations.

THE Ministry of Transport railway statistics for the month of March last have recently been issued as a Stationery Office publication, price 3s. 6d. They show that, compared with March, 1929, there was a decrease of 0·9 per cent. in the number of passenger journeys, and of 19·4 per cent. in the receipts therefrom. Moreover, there was an increase of 2·4 per cent. in the passenger train mileage. The last item is not, however, as serious as it looks, because, as we have pointed out on previous occasions, the mileage run by Sentinel-Cammell steam coaches is, in this month, of the same value as an express train, even although the cost per train mile is one-half that of a steam train. Owing mainly to a decrease of 5·1 per cent. in the tonnage of coal, coke, and patent fuel, the tonnage of freight generally fell by 2·6 per cent. The freight receipts had a decrease of 3·9 per cent. Freight train mileage, on the other hand, increased by 2·4 per cent., and the average train load decreased from 136¼ tons to 130¼ tons. Both these factors were no doubt due to the drop in the coal traffic.

ACCORDING to the Board of Trade returns the value of the railway material exported during the first four months of the present year was as follows, the corresponding figures for 1929 and 1928 are added in brackets:—Locomotives, £1,243,573 (£921,683, £1,229,286); rails, £895,998 (£986,549, £1,449,007); carriages, £528,624 (£619,221, £1,019,262); wagons, £679,303 (£927,509, £1,301,736); wheels and axles, £110,648 (£140,497, £340,569); tires and axles, £231,183 (£189,747, £213,397) chairs and metal sleepers, £279,444 (£152,649, £377,256); miscellaneous permanent way, £288,393 (£374,642, £501,645); total permanent way, £1,846,488 (£1,903,801, £2,930,968. The weight of the rails exported was 103,886 tons (117,401 tons, 168,652 tons), and of the chairs and metal sleepers, 29,708 tons (15,478 tons, 38,228 tons). During the month of April last the value of the locomotive sent overseas was £392,087, and included: India, £338,079; the Argentine, £9316; other countries in South America than the Argentine, £8369. The rails shipped during the same month were of the value of £166,034, which included: the Argentine, £18,380; South Africa, £14,984; India, £13,002; Ceylon, £9700; Straits Settlements, £7468; Portuguese East Africa, £5540; New Zealand, £778 and Australia, £270.

THE retirement of Mr. T. O. Mein, the works manager at Stratford, on June 30th, after 51 years' service, first with the Great Eastern and, after grouping, with the London and North-Eastern, is announced. Some of our railway readers may remember that during the 15 or 20 years at the end of last century there was considerable agitation for automatic couplings and that was brought practically to a head by a visit paid to the United States by Mr. Francis J. S. Hopwood—now Lord Southborough—the then head of the Railway Department of the Board of Trade. The memorandum prepared by Mr. Hopwood on his return led to the appointment of the 1899 Royal Commission on Accidents to Railway Servants. The railway companies, in anticipation of that, sent a deputation of four officers in March to inquire into American experience of automatic couplings. Mr. H. A. Ivatt was one, Mr. Joseph Constantine, the goods train superintendent of the Midland, and Mr. R. P. Ellis, the assistant superintendent of the Great Eastern, were two others, and Mr. Mein was the fourth. Mr. Mein was in the witness chair on three days and he and Mr. Constantine showed that automatic couplings, as used in America, were not suitable for British railways, and, no doubt, led the Royal Commission to report that "the successful employment of automatic couplings in America does not necessarily establish that such couplings can be adapted to the wagons in use in this country."

Notes and Memoranda.

DURING 1929 patent applications concerning wireless inventions exceeded those of the two previous years by nearly 50 per cent., according to the recently published report for 1929 of the Comptroller-General of Patents. A marked increase was shown in applications relating to thermionic valves and photo-electric cells.

IN Canada it has been found that the formation of ice in winter time is a great hindrance to the operation of hydro-electric installations. Through the formation of ice the supply channel which is provided with gratings is at night time often frozen up in a few moments. It has now been found in association with the many experiments carried out by Dr. Howard T. Barnes, who is engaged on methods for the dispersal and prevention of ice, that the irradiation of the gratings by means of powerful electric glow lamps hampers the formation of ice in a high degree. The use of thermit, sodium, and calcium for breaking up the ice has also met with successful results.

DURING the year 1929 the total number of electrified farms in the United States increased from 460,000 to 558,000, or by 21·3 per cent., and, according to the National Electric Light Association, that is the largest annual increase so far recorded. At the end of 1923 there were only 166,140 farms receiving electric service. Since that time the total number has been increasing at a rate which doubles every 3½ years. California leads in the number of farms supplied with service by the light and power companies with a total of 72,690 at the end of 1929, representing an electrification of 53 per cent. New York comes next with 53,060, Ohio third with 38,045, and Washington fourth with 37,813. Montana heads the list for the greatest percentage increase during the past year. On December 31st, 1928, the State had only 890 electrified farms, which number increased during the year to 1844, or by 107·2 per cent. Arizona comes next with a percentage increase of 93·1 per cent., and New Hampshire third with 79·1 per cent.

RADIUM is by far the most costly commodity ever commercially produced, says the United States Bureau of Mines, Department of Commerce. Unlike other things of exceptional value, such as precious stones, it is sought for utilisation rather than æsthetic purposes. A gem is prized for its beauty and rarity, its value is physchological, and its price is not determined by the cost or effort through which it was obtained from nature. The price of radium, however, is a result of its usefulness and the high costs of mining and processing the ores from which it is obtained. Many hundred tons of hand-sorted ore must be treated with expensive chemicals in order to obtain 1 gr. of radium. The carnotite ores of Colorado and Utah furnished most of the radium produced for many years. The business was competitive and the profits were not large as compared to other mining and metallurgical operations. In the Belgian Congo a deposit of extraordinarily high grade ore was found a few years ago, and from it a large tonnage of very rich ore has been mined.

THE completion of a gigantic dam on the Gatineau River, Quebec, bringing the amount of water available at all times up to 145 thousand million cubic feet, is announced in the first year's report issued by the International Hydro-Electric System, the power combine controlled by the International Paper and Power Company. This feat of engineering, which was planned to guard against the adverse effects of dry seasons, will, it is claimed, ensure sufficient water power to keep the combine's Gatineau River plant working at full capacity eight hours every working day if no rain were to fall for a year. The International Hydro-Electric System, which operates both in Canada and the United States, has now a total installed capacity of 1,300,000 horse-power, of which 852,000 horse-power is obtained from water power. As part of its scheme to electrify industrial Canada, it is stated, a 132,000-volt transmission line, 104 miles long, has been installed to connect the Grand Falls hydro-electric plant on the Saint John River with a new mill of the International Paper and Power Company at Dalhousie.

ACCORDING to statistics recently published by the Controller of the American Telephone and Telegraph Company, which show the relative use made of the telephone and the telegraph service, Canada holds the record for the use of the telephone. Each individual holds, on an average, 241 telephone conversations per year; but in two years each sends only three telegrams. The Americans, each of whom on an average telephones 230·7 times a year, send only 1·9 telegrams each. The New Zealanders, the third most talkative people on the telephone, with 209·1 conversations apiece per annum, are easily first in using the telegraph, for each New Zealander also sends 4·7 telegrams a year. The Dane, who uses the telephone more than any other European nation with 143·5 conversations per head every year, sends just over one telegram every two years. Each Japanese averages 56 telephone calls a year, but sends only 0·7 of a telegram. The Germans, who each use the telephone 38·1 times in the year, send one telegram in two years, while the Englishman uses the telephone only 30·6 times, but sends 1·2 telegrams in the same time.

CANADA possesses deposits of crystalline phosphate of lime, or apatite, that are probably the most extensive known, Norway being the only other country believed to possess important resources of that mineral. Analyses of clean, lump Canadian apatite show it to carry about 85 per cent. of tricalcic phosphate. It is a fluor-apatite as contrasted with the Norwegian mineral which is chlor-apatite, and it contains about 3 per cent. of fluorine. The Canadian phosphate bodies are found in two main districts, one in Quebec and the other in Ontario, and both near Ottawa. The deposits formally were systematically mined, and have yielded a total recorded output of over 300,000 tons, most of which was utilised in the manufacture of superphosphate, but these operations virtually came to an end about 1895 with the discovery in other parts of the world of enormous bodies of sedimentary phosphate which could be mined much more cheaply. Almost all of the small tonnage of apatite produced in Canada during the past twenty years has been obtained as a by-product of mica-mining operations, and most of it has been utilised locally in the manufacture of phosphorus and fertilisers.

Miscellanea.

THE Postmaster-General announces that as from June 19th the Anglo-Australian telephone service will be extended to Adelaide, South Australia. The charge for a call to Adelaide will be the same as that for a call to other parts of Australia to which the service is at present available.

IN connection with the Annual Conference of the Institute of Quarrying, an Exhibition of Quarrying and Building Contractors' Plant and Materials is to be held at Scarborough from July 2nd to 11th next. Exhibits arranged by the Home Office in connection with accident prevention, welfare, silicosis, &c., will be included.

NEGOTIATIONS are in progress between the Indian Radio Company and the Indian Government with a view to the establishment of a wireless telephony service between India and Great Britain An official of the General Post Office informed the *Wireless World* that such a service would be operated in this country by the stations engaged in the Transatlantic and Australian services, viz., the transmitter at Rugby and the receiver at Baldock. A further announcement may be expected in the near future.

WITH one of the specially-built Schneider Cup engines lent by the British Government and installed in a special chassis, the Australian motorist Smith proposes to make an attempt early next year to beat Sir Henry Segrave's land speed record, on a beach 90 miles in length north of Auckland, New Zealand. The engine develops 2000 horse-power and was recently shipped to New Zealand. The Auckland Automobile Association is in touch with the international body and the Royal Automobile Club to ensure that the attempt shall be made strictly in accordance with international rules.

THE Commercial Counsellor, H.M. Legation, Stockholm, has forwarded a summary translation of an article dealing with the progress of the use of electric power in Sweden, which has recently been published in the Official organ of the Kommerskollegium—Board of Trade. Statistics of electric power used in Swedish mining and industry were collected for the first time in 1906, and the figures given show the remarkable increase in the use of electric power which has since taken place. A copy of the translation may be obtained on application to the Department of Overseas Trade, 35, Old Queen-street, London, S.W. 1. (Reference C.X. 3277.)

WE learn from the National Federation of Iron and Steel Manufacturers that the number of furnaces in blast at the end of May was 141, a decrease of 10 since the beginning of the month. The production of pig iron in May amounted to 614,500 tons, compared with 619,600 tons in April and 654,800 tons in May, 1929. The daily rate of production in May was thus 19,823 tons, compared with 20,653 tons in April. The production included 187,700 tons of hematite, 248,300 tons of basic, 130,700 tons of foundry and 23,600 tons of forge pig iron. The May output of steel ingots and castings amounted to 692,800 tons, compared with 696,100 tons in April and 843,800 tons in May, 1929.

GERMAN industry, in the process of rationalisation of production, is turning to a rapidly increasing extent to the use of electricity, to judge from output figures issued by the United Industrial Enterprises Company of Germany. This concern, generally known as "Viag," was formed as a holding company for all the industrial enterprises of the German Government, and controls the largest electric system in Europe, supplying 20 per cent. of all power consumed in Germany. Electric production of Viag's operating subsidiaries obtained from hydro-electric power or from the conversion of brown coal into current at the mines, amounted during the twelve months ended March last to 3,437,930,000 kWh, compared with 3,087,654,000 kWh in 1928 and 2,775,800,000 kWh in 1927.

GREAT BRITAIN, France, Italy, Belgium, Germany, Austria, Hungary and Holland were each represented by four members at the first meeting of the newly constituted International Research Commission for motorless aeroplanes, which has just been held at Frankfort. Professor Georgii, the scientific director of the Rhoen-Rossitten Society's Institute, on the Wasserkuppe, was elected president of the Commission, and the Master of Sempill, President of the Royal Aeronautical Society, vice-president. The meeting decided that Frankfort should be the seat of the Commission for the next nine years. It may be recalled that this Commission is the outcome of an international conference of various bodies interested in the science of motorless flying craft held at Darmstadt last March.

MORE than forty Marconi telegraph installations have recently been ordered for trawlers in the Humber district. The specially designed trawler installations comprise a telegraph transmitter and receiver, with, usually, a direction finder. The transmitter is tuned to a special wave length for communicating with other trawlers, in addition to the normal maritime wave length for working with ships and coastal stations. The receiver has a comprehensive wave range which makes it possible to tune in broadcasting stations for weather reports, news bulletins, and also the high-powered stations which transmit time signals, navigational and meteorological reports, and other useful information. The direction finder has proved itself to be of great assistance in fixing the exact bearing and position of other ships and land stations, and has thereby saved time and money on many occasions.

Now that the Electricity Commissioners' statistical returns have been brought up to date—three volumes having been published within the last twelve months—the Commissioners will endeavour to publish subsequent returns not later than December of each year. By this means they believe that the value to the industry of the information contained therein will be increased; but this result can only be attained if all undertakers will co-operate with the Commissioners by rendering their individual returns at the earliest possible date after the close of their financial year. The Commissioners particularly request those undertakers, whose year ends on December 31st, to furnish their returns promptly, in order that they may be dealt with and compilation proceeded with before the returns relating to other undertakers whose year ends at a later date can be rendered.

MONTREAL HARBOUR BRIDGE OVER THE ST. LAWRENCE RIVER

(*For description see page* 705.)

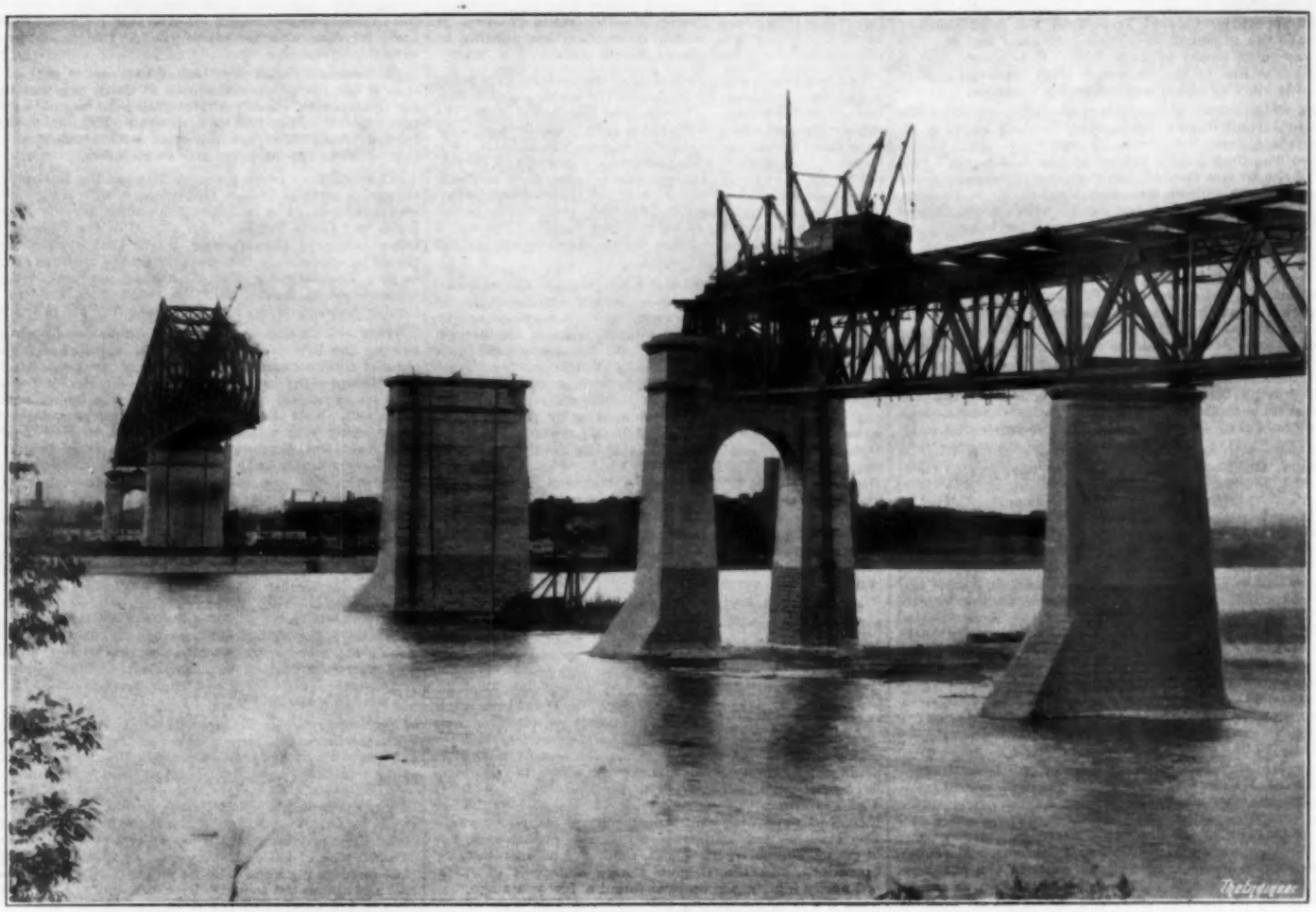

FIG. 7—MAIN SPAN, SOUTH SIDE—TEMPORARY PIER UNDER CONSTRUCTION

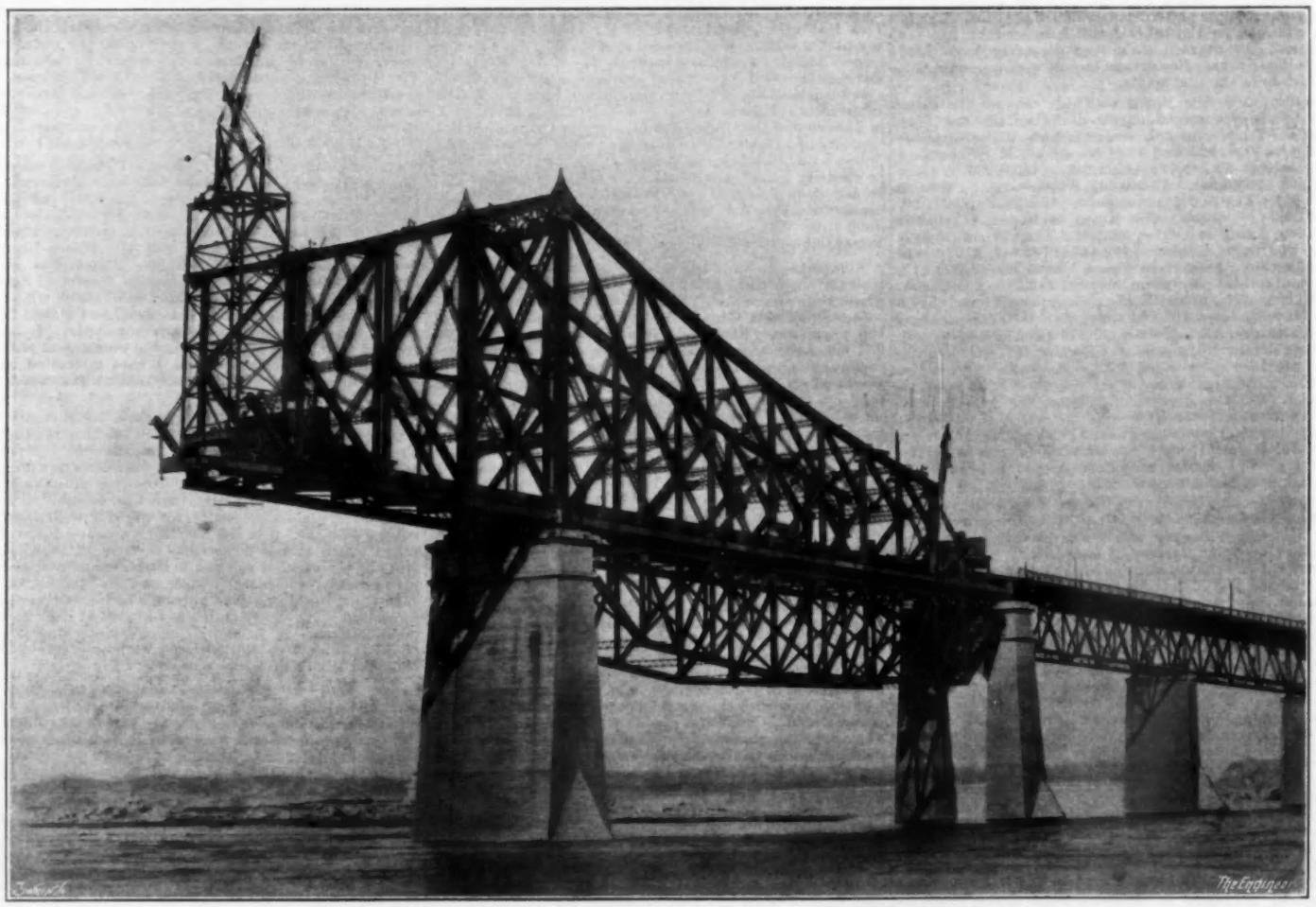

FIG. 8—MAIN SPAN, SOUTH SIDE—ERECTION OF CANTILEVER ARM

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The Metallurgist.

THE JUNE NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ENGINEER.

VOL. CXLIX No. 3885

JUNE 27, 1930.

The Automatic Stabilisation of Ships.

THOSE of our readers who have followed the series of articles, concluded in this issue, on the automatic stabilisation of ships, are now, it is hoped, in a position to understand the fundamental principles involved and to follow with discrimination the numerous attempts that have been made, with varying degrees of success, to apply them. It is as significant as it is striking that these efforts to attain a common object have led inventors along several widely separated paths. Mechanically moved weights, water chambers, gyroscopes, lateral fins and the control of the reaction couple of the main propelling engines, have all been seriously tried or proposed. Each of these methods has its own merits and its own disadvantages. The mechanically moved weight system is in theory at least capable of fulfilling the requirements for complete stabilisation, but, apparently, insuperable difficulties are encountered in devising a practical and certain means of varying the movement of the weight automatically to suit the varying magnitude and period of the waves. The gyroscopic system also is available as a means of imparting complete stabilisation to a vessel, but in the past it has been deemed desirable or found essential to economise space and weight by applying it for partial stabilisation only. The water chamber method is inherently incapable of suppressing all rolling; it can, at best, only reduce the amount of the motion. The lateral fin system provides a stabilising couple which is dependent upon the forward velocity of the ship; when the vessel is at rest the automatic stabilising effect of the fins vanishes and they become no better than bilge heels. Several serious practical objections attend the proposal to provide the stabilising moment by automatically controlling the reaction couple of the main propelling engines; in addition, it seems certain that in most vessels under most conditions, the stabilising moment so provided would be considerably less than the value required. It may, then, be generally concluded that despite the time, ability and money that have been expended on developing means for the automatic stabilisation of ships, the field for invention is still by no means saturated.

A general analysis of the problem shows that it presents several separate elements. First, there has to be provided some means of generating and applying to the ship a force which will counteract the heeling moment contributed by the waves to which she is exposed. The magnitude of this force may be roughly indicated. For a 2500-ton cross-Channel steamer it is of the order of 40 tons acting at a distance of 10ft. from the centre line of the ship. For a larger vessel of similar type having a displacement of 4500 tons the counteracting force required is equivalent to a weight of about 115 tons acting at an equal distance. A 10,000-ton warship would require a force of some 525 tons at 10ft. from the centre line and a passenger and cargo steamer of 11,600 tons displacement, a force of over 600 tons at the same distance. These forces are far from insignificant and a minor practical problem is to provide means whereby they may be applied to the hull sufficiently distributed not to overstress any part of the ship's structure. The forces named are those which would be required to stabilise the vessels completely if they were exposed to waves of a particular magnitude; specifically if the height of the waves from crest to trough were a twentieth of their length from crest to crest. If this ratio were different the forces required would be different. Hence, a second element of the problem is to devise means whereby the magnitude of the applied force—or, alternatively, the distance of the point of its application from the centre line of the ship—shall vary automatically with the magnitude of the waves. It is to be noted that a train of waves of constant height-to-length ratio is rarely encountered. More generally, this ratio varies almost from wave to wave in any one train. The device provided for controlling the magnitude or point of application of the counteracting force must, therefore, be able to act quickly if the stabilisation is at all times to be fully effective. Thirdly, it has to be observed that the heeling moment applied to a ship by a train of waves rises with each wave from zero to a maximum value in one direction, falls to zero again and then passes to a maximum value in the opposite direction. It is, therefore, necessary that the counteracting force should pass through a similar cycle. In other words, means have to be provided for reciprocating the point of application of the counteracting force from side to side of the vessel, or, alternatively, for causing the force to grow from zero to a maximum value and then to fall again to zero at a fixed point on the port side of the centre line and, subsequently, to pass through a similar cycle with respect to a fixed point on the starboard side. If the vessel is to be fully stabilised this growth, decay and reversal of the counteracting force, or, alternatively, the reciprocation of its point of application from side to side of the centre line must be accomplished in the natural period of the waves. That period may be anything up to 9 or 10 seconds—in very extreme cases up to 24 seconds—and accordingly the system provided for producing the fluctuation in the counteracting force must be capable of producing that fluctuation within varied intervals of time. It is unfortunate that the period of a train of waves bears no relationship to the height-length ratio. If the one were proportional to the other the arrangement for controlling the magnitude of the counteracting force could be coupled up with the arrangement for controlling the period of its fluctuation. Assuming that a satisfactory method of generating the counteracting force, of producing variations in its magnitude and of causing it to fluctuate between maximum values in opposite directions in a variable interval of time has been found we come to the fourth element of the problem. Some method must be devised for determining the height-length ratio and the period of the waves and of signalling the measurements to the stabilising equipment. If the stabilisation is to be fully effective the determination of the magnitude and period of the waves and the signalling of the results must be effected without time-lag. Should there be a lag the counteracting force will be applied out of phase with the heeling moment of the waves and the stabilisation will at best be only partial. If the lag is excessive the intended stabilising effect may become an upsetting effect, assisting the waves to roll the vessel. Finally, having provided all these requirements,

we are left with the difficult problem of making the stabilising equipment set the magnitude and period of fluctuation of its counteracting force promptly in accordance with the values signalled to it. Here, again, there must be no lag if the stabilisation is to be fully effective.

This analysis of the requirements of a complete stabilising equipment provides a standard whereby to judge the perfection of any such equipment, produced or proposed. In the various equipments so far tried it is not always easy to separate out the items provided for the different functions enumerated in our analysis. In the Frahm anti-rolling tank system they are all combined in such a way as practically to defy analytical separation. It is evident, however, that this system falls short of the ideal because of an inherent defect in the method employed for measuring the magnitude of the waves and determining the amount of force to be applied to counteract them. The criterion employed is the extent to which the waves roll the vessel. The counteracting force cannot, therefore, become effective until the motion which it is desired to suppress has manifested itself. It is impossible, under these conditions, to suppress all motion. It is only possible to make it less than it otherwise would be. In the Sperry gyroscopic stabiliser a small quickly acting pilot gyroscope determines the instants at which the counteracting force should come into action and at which it should vanish and reverse. The system falls short of perfection because it does not vary the magnitude of the counteracting force to suit the magnitude of the heeling moment. The counteracting force has a constant maximum value whatever be the magnitude of the waves. It is merely kept on for a longer or shorter time to suit the period of the waves. In the Schlick and Fieux gyroscopic systems there is no pilot gyroscope. The stabilising gyroscope has itself to act as pilot as well as stabiliser. Theoretically, it can fulfil both functions, but in practice the device which generates the counteracting force is bound to be sluggish as a detector for determining the magnitude which that force should have. If perfection is to be reached, it would appear to be essential that each function to be fulfilled should be assigned to a separate element. The problem facing the inventor in this field is to produce an equipment, low in first cost and cheap to install and operate, which will impart complete stabilisation to a vessel without involving intolerable complexity, the occupation of excessive space, and the addition of more than two or three per cent. to the displacement of the ship.

Electricity Supply.

THE Electricity Commissioners' publications are always interesting and instructive and throw much light upon the position of electricity supply. Possibly few have the time or inclination to study all they contain, but it is usually a simple matter to pick out the most essential and important facts. The latest return of engineering and financial statistics relating to authorised undertakings in Great Britain for the year ending March 31st, 1929, or May 15th, 1929, for public authority undertakings, and December 31st, 1928, for company undertakings, dealt with in our last issue, shows that, since the preceding return, improvements had been effected in various directions. The sales of electricity to consumers showed an increase of over 796 millions, or upwards of 11 per cent., on the figures for 1927–28. Sales of electricity for lighting and domestic purposes increased by 328 million units, whilst the energy sold for power purposes showed an increase of 389 million units. Public lighting and traction also gave rise to a greater demand. During the year there was an increase of upwards of 394,000, or about 15 per cent. in the number of electricity consumers. Economies continued to be effected in the utilisation of fuel in steam-driven generating stations, for the average fuel consumption per unit generated during 1928–29 was 2·04 lb., as compared with 2·16 lb. during 1927–28. But to gain a real idea of the savings that have resulted from the progressive improvements in power station equipment it is essential to refer back to 1920–21, when the average consumption per unit generated was 3·42 lb. Since 1920–21 technical developments have resulted in an all-round increase of 67 per cent. in the amount of electricity obtainable per ton of fuel at the generating stations of authorised undertakers as a whole. This improvement reflects great credit on the designers of power station equipment, as well as upon operating engineers who now strive their utmost to obtain the best possible results. There is no doubt that the Electricity Commissioners' reports have had a healthy effect on the electricity supply industry by showing the results obtained at the various stations. No engineer likes to see his plant efficiency below that of other stations working under similar conditions.

But, apart from efficient operation, much remains to be done in the electricity supply industry in order to secure the best possible results. A considerable amount of inefficient plant is still in existence, and the load factor in many cases leaves much to be desired. During 1928–29, sixty undertakings were working at load factors under 15 per cent., and 158 at load factors under 20 per cent. Only 13 undertakings had load factors of 45 per cent. and over. While good progress is being made with the construction of the "grid," it will, we fear, be a considerable time before anything approaching ideal conditions of generation and supply are attained. The full realisation of the benefits of the unification of control and interconnection cannot be secured until the whole programme of frequency standardisation has been completed and all the inefficient plant has been put out of action. The greater availability of electricity throughout the country on the completion of the "grid" is, of course, expected to result in a considerable increase in the consumption of electricity per head of population, which, at present, is far from satisfactory. For Great Britain as a whole on the basis of the estimated population of 44·4 millions in 1928, the sales of electricity by all authorised undertakers in 1928–29 represented an average consumption of approximately 176 units per head of population, whilst the previous return, covering 1927–28, gave the figure of 158 units per head of population. It is important to note, however, that these returns relate exclusively to authorised undertakings providing public supplies in Great Britain. To obtain a complete measure of the extent of electrical development in the country, account would have to be taken of the supplies utilised by railway and tramway authorities and derived from their own generating stations, of the large number of private generating stations established by collieries and other industrial and commercial organisations for the purpose of their respective undertakings, and of cases in which supplies are given by undertakings without statutory powers. The Commissioners' publications do not aim at showing the total amount of energy generated or sold during any given year, but the annual reports go further in this direction than the returns. The ninth annual report of the Commissioners, covering the period of April 1st, 1928, to March 31st, 1929, gave the total number of units generated as 10,878,980,925. In addition to public authority undertakers this figure covers railways and tramways and certain non-statutory undertakings with 20 stations, which naturally represent only a small proportion of the private installations. A recently issued pamphlet dealing with electricity supply in fifty-one countries gives the total energy generated in Great Britain during 1929 as 16,200,000,000 units, whilst in *World Power* of September, 1929, Mr. Hugh Quigley gives the total output in 1928 as 14,960,000,000 units. To this, he explains, should be added the outputs by commercial plants attached to offices and banks and similar buildings, giving a total of about 15,600,000,000 units, equivalent to about 355 units per head of population.

From these figures it is evident that private plants play an important part in the supply of electricity in Great Britain, and when studying the Commissioners' reports and returns it is essential to take this into account. The "grid" is, of course, expected to result in a considerable decrease in the number of these plants, but the prospect of eliminating anything like all of them is very remote. In certain industries, where steam is required for process work, it is by no means easy to persuade manufacturers to scrap their existing generating equipment. Again, at collieries, where cheap fuel is available, a supply from the "grid" is not usually considered to be advantageous; in fact, judging from the correspondence columns of one of our contemporaries some of the collieries would prefer to supply electricity to the Board. Colonel D. L. Selby-Bigge has suggested that in various coalfields there are local conditions favourable to joint action by individual colliery undertakings in the direction of group electricity supply using the low-grade fuel. A number of collieries suitably placed relatively to one another might, it is considered, erect a fairly large generating station and give the Board a bulk supply after satisfying their own requirements. We do not suppose for a moment that the suggestion will meet with approval, as it is the desire of the Board that the collieries should obtain their current from the "grid." The collieries, however, are in a position to generate cheap current themselves, and it remains to be seen how many of them will scrap their plants and purchase current from outside. On the other hand, there are probably many manufacturers in a less favourable position as regards obtaining exceptionally cheap fuel, who would like to be relieved of the trouble and expense of generating their own electricity and who will be glad to avail themselves of the facilities offered by the National Scheme. Public organisations are becoming more and more responsible for developments in electric power production over the country as a whole, but there are certain industries in which the private plant will probably always be difficult to displace.

Sixth Annual Advertising Convention.

THE sixth annual Advertising Convention was held at Hastings from June 21st to 25th, under the chairmanship of Lord Riddell, the President of the Advertising Association, Incorporated.

At the opening general session on Monday, 21st inst., Lord Riddell read the following message from the Prime Minister :—

"During the next few days I shall watch with great interest all news of the proceedings of your Annual Convention. The subjects which will be deliberated and the friendships which will be made or strengthened are no longer matters of private interest only. They concern the nation. Clean and honest advertising means clean and honest business dealing. These in turn affect the whole moral tone of our people.

"In the international sphere this is of great—nay of fundamental importance. Our good name depends on it as well as our economic well-being. To pay for the food and raw materials which we import and must import, this country must export increasing quantities of manufactured goods. To a former generation it appeared that this aspect of our national life could be left to take care of itself. Our industrial equipment was a generation ahead of that of any other nation. Our goods could sell themselves. To-day all this has changed. Each of the great nations of the world has established and organised its industrial equipment on modern and efficient lines.

"Our position as exporters of manufactured goods is thus undergoing a new challenge. We have to face the prospect of ever intensified competition. A new national effort is required to meet this situation. On the other hand, the rising standard of comfort means that our customers in other countries have now more to spend on imports. The purchasing power of the world markets is bigger than ever before and is increasing. To win and maintain our position in the world of the future calls for great development in the art of salesmanship, of which advertising is an important part. On these grounds I wish your Convention every success."

As the title for his presidential address Lord Riddell had chosen "Increasing Trade by Advertising." The progress of the Advertising Association had, he said, been remarkable. At the present time, through its thirty-nine constituent clubs and affiliated associations, it comprised no fewer than 12,000 members, all engaged in the business of advertising. The Association provided a common platform on which all sections of the trade could meet and discuss problems in which they were mutually interested. Since the Association was formed in 1924 advertising had made enormous strides in quantity and quality. The nation had developed what might be called an "advertising sense." In other words, the need for advertising was realised and all sections of the community had come to take an interest in advertisements and advertising methods. Nevertheless, much missionary work remained to be done. The fact that advertising was an essential factor in sales machinery was not yet adequately realised. Even now many business people imagined that the right goods, properly marketed at the right price, would sell themselves. They did not appreciate that if the vital spark of publicity was missing they could not hope for a satisfactory profit and loss account. They were also prone to forget that increased sales reduced manufacturing costs.

Lord Riddell then went on to urge that, in the national interest, it was essential that the Association and its members should continue their propaganda with unabated zeal and energy. That they should do so was specially necessary at a time when our country, like other countries, was struggling through a metamorphosis which was due to increased production, changing habits, a falling population and a reduced number of wage earners. Available figures showed that, while the world's population in 1927 was about 9 per cent. greater than in 1913, the production of foodstuffs was 13 per cent. greater and that of raw materials 35 per cent. greater. There was a glut of wheat, cotton, rubber, coffee, tea, tin, potatoes, oil and coal. But that was not the whole story. Improved technical efficiency had largely increased the output of finished products from a given quantity of raw material. Further, products of the older trades were being largely supplanted by those of newer industries and changing habits were diverting expenditure into fresh channels. The world was spending proportionately less than in pre-war days on food, clothing, coal and fodder, and more on motor cars, picture palaces, newspapers and wireless sets, and was replacing cereals by vegetables and fruits. Enormous changes, too, had been brought about by the disappearance of the horse, which had altered the whole basis of agriculture by reducing the demand for coarse grain. On the other hand, the demand for oil was steadily increasing, although it was not keeping pace with the supply.

These perplexing conditions were made more troublesome, first, by the failure of retail prices to fall in sympathy with the heavy drop in wholesale prices, and, secondly, by

a reduction in the number of wage earners and potential consumers brought about by intensive mechanisation and rationalisation. Moreover, the increased employment of women had shifted a large proportion of spending power to a new class with fresh wants. It was also obvious, continued Lord Riddell, that before long the producer would have to face the problem of smaller populations.

The world would take some time to cope with these awkward problems. Judicious advertising was an essential factor in their solution. Redundant stocks must be cleared, old trades and services must be revised and revived and new ones developed and explained. In short, publicity was necessary to help the public to adapt itself to continuously-changing conditions. We could not hope for better times until producers had cleared the stocks of primary materials which were clogging the wheels of commerce.

We must remember, too, that the accumulation of stocks prevented producers and their workers from purchasing and consuming what they would otherwise require. Judicious advertising was one of the chief methods available to bring about a return to normal conditions. It must be borne in mind, however, that advertising alone would not sell goods or services. The things themselves must be the right things—they must be sold at the right price and marketed in the right way. Nothing was worse for advertising than unsatisfactory results, and advertising that did not pay was a menace to the business as a whole.

Sir Ernest Benn, speaking on the subject of the address, said that he supposed that there was no matter on which people generally were more prone to think in a superficial way than upon the development of trade and industry. Some people still liked to think that the man who invented a thing was the real benefactor of the human race, and there was, of course, a good deal to be said for that point of view. For himself, he doubted sincerely whether the delights and benefits which he derived from the use of electricity were more due to the efforts of Faraday than to the life's work of Hugo Hirst. No single cause could be held responsible for any given result, but he clung to the belief that the greatest of the benefactors in the matter of trade and industry was the man who brought the article or the service within the reach of the people who wanted it, and that, of course, was the advertiser.

Then there was the other and the kindred idea that the maker or the worker was the all-important factor in the development of trade and industry, and that idea was all too slowly losing ground. It was invented by Karl Marx, who told us that wealth was labour applied to land. Out of that false notion had arisen all the de-civilising tyranny of the trade union idea. If wealth was land and labour, then music was catgut and horsehair and literature was paper and ink. He believed, Sir Ernest continued, that all the land represented by raw materials, and all the labour, whether by hand or brain, which was put into the invention and the making of material amenities for the use of man, were futile and useless until the advertising idea brought them into service. Wealth was no wealth at all until the man who made it had got rid of it. It was always a mere incumbrance to the inventor and to the maker. It only became wealth when somebody had found somebody else who wanted it, and that was the function of salesmanship and advertising. In writing the prescription of wealth, we must therefore teach the people to put at the head of the list of its ingredients the simple word "Advertising."

Two of the subjects dealt with at the Industrial Press Session were :—"The Voice of Industry—the Trade Press," and "The Trade Press as a Link between Manufacturer and Distributor." The first was introduced by Mr. Holbrook Jackson, the Editorial Director of the National Trade Press, Ltd., and Heywood and Co., Ltd., who remarked that there were business men, even in this age of print, who looked upon the trade journal as a necessary evil rather than a necessary implement in the successful manipulation of business. They went to it when they were in trouble, as they went to a lawyer or called in a doctor. That was a compliment, but common sense would dictate the opposite method of procedure, on the principle that it was better to invite a lawyer to keep you on the rails, or a doctor to keep you fit, rather than to wait until you were off the rails or thoroughly ill before you took professional advice.

But, perhaps, that minority was not entirely to blame. There was an American proverb which ran, "When uplifting get underneath," and he thought that the indifference might be due somewhat to the failure of the proprietors of the trade press in this country to get underneath their own problems. There was no doubt that the trade press was the voice of the industry, but it had not succeeded in putting across the voice of its own industry, otherwise there would be no doubters.

In that it was unjust to itself and unfair to industry. The trade press was a necessity. It performed an indispensable service, the complete and enthusiastic recognition of which by all business men would be of incontestable benefit to all. It was not necessary to seek other than business reasons why business men should advertise their goods, and when such reasons came to hand it was unbusinesslike to ignore them. He had, he said, only one complaint to make against the trade press. It was that it had not only ignored the gentle art of self-praise—which was the essence of advertisement—but in doing so it had also ignored opportunities of spreading the news of its own value. If the trade press was the voice of industry, it should not be ashamed of saying so, and it should say so with all the forcefulness of modern publicity.

The trade journal was the voice of industry because it was the indispensable link between the manufacturer and the retailer. It was the buyer's forum. In its pages were discussed all the problems of retail distribution from the selection to the disposal of merchandise. It was something even more than the link between the manufacturer and the retailer. It was the last lap of the race of merchandise from the factory to the consumer. Unless that lap was successfully run, goods were not likely to reach the winning post. From the manufacturer's point of view, the trade journal was the shop window by means of which he might introduce his goods to the retail buyer, whether he sold direct to him or through a wholesaler. The trade journal had the advantage of permanence; it was retained for reference, and, finally, the trade journal was a traveller who went into all lands and spread the news of the latest goods in markets inaccessible to the personal traveller.

Speaking on "The Trade Press as a Link between Manufacturer and Distributor," Mr. P. A. Best, managing director of James Shoolbred and Co., Ltd., said that he was glad of an opportunity to express his appreciation of the services rendered to distributors by the trade press of England. It would be difficult to say how greatly all retail distributors were indebted to the trade press. For himself, in fact, it would be no exaggeration to say that those publications were indispensable to the conduct of his firm's increasingly complex affairs. He had been glad to note the great improvements that had been made in those journals since the war. In the past, the trade journal was the Cinderella of Fleet-street, and looking backwards he found that it would be other than honest for him to say that it deserved that position. But there had been great changes. The newer type of trade journal in this country was equal to the best journalistic productions of America, and in some instances we had admittedly set an example which even our friends in the United States were proud to acknowledge and to follow.

The reading of trade papers should be better organised by the proprietors of retail establishments. A trade journal was of supreme importance to every responsible member of the trade, because it gave a service to retailers which could not be obtained elsewhere and was, therefore, an organ of information and even of education, which should be as widely distributed in a given store as possible. Individual members of the staffs of our business houses should be encouraged to read their trade journals. The keener members of all staffs subscribed individually. It was the less keen who provided the problem, and as a store manager he would like to say that he had no very high opinion of those retail distributors who did not study their trade papers carefully. In many of the leading stores in England and America the proprietors subscribed for the principal trade journals and distributed them throughout the responsible members of the staff. The method adopted was to attach to the back cover a label containing a list of the names of the members to whom it was to be circulated.

In the Newspaper Management Session, Mr. H. G. Saward, F.I.P.A., managing director of Saward Baker and Co., Ltd., gave an address entitled "How can Newspapers Help in Creating New Advertising?" He summed up his solution to the question as follows :—

First.—He recommended that they should desist from creating or unduly enlarging upon an atmosphere of pessimism, which is inimical to the development of sales and consequently of existing advertising and to the opening of new advertising accounts.

Second.—That they should foster invention; press for the removal of every public impediment to progress; stimulate the public and implant in them a new energy, a new confidence, a new appreciation of work, and the will to do it.

Third.—That they should encourage the desire for a higher standard of living—even for the luxuries of life—just as fast as scientific progress makes those amenities available.

Fourth.—That they should acquire an understanding and a personal knowledge of the work, *personnel*, aims and abilities of British Advertising Service Agencies; and

Fifth.—That they should form a committee to raise a central fund by the subscription of one farthing in the pound sterling on the advertising turnover, for the re-statement of the case for advertising in the light of present-day conditions.

There was, he said, a law in economics—which was called Gresham's Law—that the worst form of currency in circulation regulated the value of the whole currency and drove all other forms of currency out of circulation. There was the same law in commerce. The debased coinage of pessimism was breaking the tendency in this country of people to trust each other. The masses were getting nervous; clerk and artizan were wondering how long they would hold their jobs, how long before the firm for which they were working will be sold or go under. It was time for the newspapers, which more than most depended upon that "trust in each other," to take a hand and explain in an organised manner what good advertising and salesmanship would do for the credit of British business and the profit of British workers.

There was, he contended, nothing intrinsically wrong with British business. The old and individual spirit of enterprise was not dead. It was not even languishing; at worst it was waiting till the clouds had rolled by. "Young England," he concluded, "is straining at the leash, keeping its energy live and vital by keenness in sport or training for the chance to come—striving to break through restraint—ready to race to business success. The Press and advertising can force the pace. Instead of depression, create and increase confidence—display the basis and argument for such confidence—and the newspapers will find no dearth of new advertising or of new advertisers."

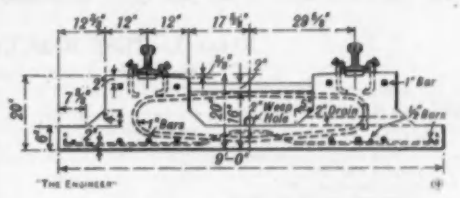
A Novel Form of Permanent Way.

AN experimental length of permanent way which was laid down last August on the Pere Marquette Railroad was described in a paper read before the Engineers' Club of Philadelphia a few weeks ago by Mr. Paul Chipman.

The new installation consists of twenty sections, each 19ft. 6in. long, or one-half the length of a rail, instead of a full rail length as in the previous installation. The tongue and groove joint was retained and strengthened by reinforcement. The construction may be described as a platform 9ft. wide and 6in. thick, from which arises a girder under each rail. These girders are 2ft. wide and have a depth of 14in. above the top of the platform, giving a total depth under the rail of 20in. At intervals of about 6ft. are heavily reinforced cross walls connecting the girders. The girders are reinforced at top and bottom, and the platform is reinforced transversely and longitudinally.

Under the rail is a shallow depression, in which is placed a creosoted yellow pine board somewhat thicker than the depth of the depression and slightly narrower than the base of the rail. The rail is held in place by steel anchors set in the concrete. The portion of these anchors projecting above the concrete is inclined towards the rail. A short bolt is threaded through the inclined portion of the anchor, and the end of this bolt impinges on a small steel casting resting upon the shoulder of the rail base and conforming loosely to it. This arrangement permits a limited amount of both horizontal and vertical adjustment, and also makes it possible to remove and replace the rail with ease. These rail fastenings have now been in service seven months and give every indication of being a satisfactory solution of this problem.

For about one-half of the length of the new installation a ⅛in. strip of rubber was placed in the bottom of the depression, below the board upon which the rail rests. This was done with the thought that perhaps the thin wood



NEW TYPE OF PERMANENT WAY

cushion might not sufficiently reduce the feeling of rigidity, making it desirable to use an additional layer of more elastic material. Experience indicates that that is not the case and that the layer of wood is all that is needed.

A further advantage of seating the rail on a slight compressible bearing is the improved holding power of the rail fastenings. In the former installations the south rail rests directly on the concrete, while the north rail is separated from it by a ¼in. layer of pressed wood insulating fibre. Since the fibre was installed there has been no creeping of the north rail, but more or less trouble has been experienced with the south rail. Placing a layer of softer material between the rail and the concrete seems to give the fastenings a firmer grip on the rail, and the bolts are kept sufficiently tight without difficulty.

There has been no creeping of the rail on the new section, since the bolts were tightened down after the first few days of operation. Its behaviour indicates that expansion and contraction due to temperature changes are confined to each rail as a unit, and are considerably reduced by the transmittal of stress to the support. With the rail firmly anchored to a massive support it appears to be quite feasible to lay the joints at ordinary temperatures with no allowance for expansion, or even to eliminate most of them by welding.

BOOKS RECEIVED.

Electric Testing Simplified. By H. H. U. Cross. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. Price 5s. net.

W. Stoddart: A Biographical Sketch. By L. Hanbidge. London: The Westminster Press, 11, Henrietta-street, W.C. 2. Price 2s. net.

Metalliferous Mine Surveying. By T. G. Hanton. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. Price 15s. net.

Flow of Gases Through Beds of Broken Solids. By C. C. Furnas. Washington: The Superintendent of Documents, D.C., U.S.A. Price 30 cents net.

Drilling and Blasting in Metal Mine Drifts and Crosscuts. By E. D. Gardner. Washington: The Superintendent of Documents, D.C., U.S.A. Price 40 cents net.

The Ancient Bridges of the South of England. By E. Jervoise, A.M. Inst. C.E. London: The Architectural Press, 9, Queen Anne's-gate, S.W. 1. Price 5s. 6d. net.

American Civil Engineers' Handbook. Fifth edition. Edited by T. Merriman, T. H. Wiggin, &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 40s. net.

A Hundred Years of Publishing: Being the Story of Chapman and Hall, Ltd. By Arthur Waugh. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 15s. net.

Engineering Materials. Volume III.: Theory and Testing of Materials. By Arthur W. Judge. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C. 2. Price 21s. net.

Economic Conditions in the Dominion of New Zealand. Report by W. D. Lambie. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. 6d. net.

Economic Conditions in Chile, November, 1929. Report by E. Murray Harvey, O.B.E., M.C. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 3s. net.

Sheet and Tin-plate Rolls: An Investigation into the Roll Loads, Stresses and the Causes of Roll Breakage. By J. Selwyn Caswell, M.Sc. Cardiff: The South Wales Institute of Engineers, Park-place.

Facts relating to the Production and Substitution of Manufactured Gas for Natural Gas. By W. W. Odell. Washington: D.C., U.S.A., The Superintendent of Documents. Price 35 cents net.

History of the Canterbury and Whitstable Railway Company: Centenary of Opening, May 3rd, 1930. By Rev. R. B. Fellows, M.A., LL.M. Canterbury: J. A. Jennings, Ltd., the *Kent Herald*. Price 6s. net.

The Moisture Content of Wood, with Special Reference to Furniture Manufacture. Forest Products Research Bulletin, No. 5. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. net.

A Survey of Scottish Coking and Furnace Coals. By T. Gray, LL.D., &c., assisted by T. H. P. Heriot and W. J. Skilling. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 4s. net.

Oil Engine Driven Generating Plant at the Hennigsdorf Peak Load Station.

No. II.*

In our last article we gave a general description of the Hennigsdorf peak load station—a general outside view of the station is reproduced in Fig. 8 opposite—and its plant. We now proceed to discuss the results of the independent test to which we alluded in that article.

Independent Test.

The acceptance tests of the plant were successfully carried out in July, 1929. After the alterations to the silencer chambers, referred to in our last article, had been made it was desired to ascertain whether the performance of the sets had been altered in any way by what had been done. In order to do so, Ministerialrat W. Laudahn, who was assisted in the work by Dr.-Ing. Walter Pflaum, carried out further tests in December, 1929, which are summarised in what follows. The complete test figures for No. II. generator set are reproduced in Table No. I. It should be stated that the values given in brackets represent extrapolated and not measured figures. Each condition of loading was maintained for 1½ hours, the actual period over which the measurements were made being, according to the load, from twenty to forty minutes. Before the first test at half-load was made the engine was run for an hour at three-quarters load in order to warm up the cylinders thoroughly.

Test Methods and Instruments.

The electrical measurements were taken with calibrated meters arranged on the sets, which were checked with precision instruments by the two wattmeter method. The engine output was recorded every ten minutes, while the wattmeter readings were taken every two minutes. Independent readings were also made by a second engineer, and the mean difference of the sets of readings taken was, we understand, not more than 0·9 per cent. The general conditions of loading were good, since a very even load was maintained on the supply network, and practically no variations took place. The indicators used were of the Maihak pattern, with a 0·49 mm./at. spring. The power distribution in the different cylinders was shown to be very even, as is clearly indicated by the figures reproduced in Table II. As the indicator drums were driven by a some-what long cord attached to the cylinder lubricating oil pump, a slightly shorter diagram than usual was obtained, and the diagrams were therefore corrected by using a value obtained on the test bed at the makers' works, where a very short direct indicator drum drive was possible. The curves, reproduced in Fig. 9, show the indicated horse-power, the fuel consumption, the exhaust gas temperature, &c. The good shape of the curves indicates the regularity of the readings and the good performance of the set. The speed of the engine was ascertained from a revolution counter continuously in operation, and the mean speed from the frequency diagrams. Throughout the whole of the testing period the speed was quite even. A specially calibrated balance, which was checked by a meter attached to the fuel piping on the engine, was employed for determining the weight of fuel used. For measuring the amount of cooling water employed a V.D.I. standard nozzle was used in the outlet pipe from the cylinder cooling system, while for measuring the piston cooling water a sharp-edged notch was used. The methods of determining the flow were those of A. D. Muller and W. Pflaum—see "V.D.I. Research," Vols. 49 and 298. The gases were analysed in an Orsat apparatus.

The Test Results.

The principal observed and calculated values for the indicated horse-power, fuel consumption, &c., are given in the curves reproduced in Fig. 9. The notation is that of the new rules for internal combustion engine tests which have been prepared by a committee of the V.D.I. and which will shortly be published. In this notation N_w represents the power developed at the engine coupling. The usefnl horse-power N_n is the engine output N_w less the proportion of that output absorbed in driving the auxiliaries.

In Fig. 9 are given the indicated horse-power N_i and the

Table I.—Test Results of Generator Set at Hennigsdorf Peak Load Station.

Ten-cylinder, Airless Injection, Two-stroke, Double-acting Engines, Cylinder Diameter 600 mm., Bore 900 mm., R.p.m. 214.

Ref. No.		5	1	4	3	2	Remarks.
	Load	½	½	¾	¾	1	
1	Day of test	Dec. 16th	Dec. 13th	Dec. 13th	Dec. 13th	Dec. 13th	These and the following figures are rounded figures taking into account the accuracy of observation and the values obtained from readings 4 and 5
2	Mean speed, r.p.m.	214·0	214·0	214·3	213·8	214·2	
3	Indicated output N_i, H.P.	—	7,740	9,755	11,175	12,700	
4	Electrical output N_{el}, H.P.	4,170	6,340	8,300	9,660	11,150	
5	Efficiency of generators η_{el}, per cent.	92·8	94·5	95·3	95·5	95·6	Taken from makers' curves
6	Engine output $N_w = \frac{N_{el}}{\eta_{el}}$, H.P.	4,490	6,710	8,710	10,120	11,660	
7	Power taken by turbo-blower and circulating water pump $N_h = N_g + N_k$, H.P.	900	890	908	908	896	After transformation losses. Mean $= N_{hm} = 900$ B.H.P.
8	Effective output $N_n = \frac{N_{el} - N_h}{\eta_{el}}$, H.P.	3,525	5,770	7,760	9,170	10,720	
9	Ratio of blower power to effective output N_g/N_n	0·246	0·148	0·114	0·0946	0·0801	Absolute mean : $N_{gm} = 866$ H.P.
				Fuel Consumptions.			
10	Fuel consumption B, kg./h.	737	1,053	1,359	1,603	1,904	
11	Fuel consumption $b_w = B/N_w$, grams per H.P. hr.	164	157	156	158	163	
12	Fuel consumption $b_n = B/N_n$, grams per H.P. hr.	209	182·5	175	175	177·5	
13	Air used, calculated from exhaust and fuel according to output N_n, kg. per H.P. hr.	—	15·1	10·7	8·99	8·06	
14	Cooling water corresponding to N_n :						
	(*a*) Cylinder cooling, kg. per H.P. hr.	—	11·62	10·81	9·89	8·52	Including lubricating oil cooling
	(*b*) Piston cooling, kg. per H.P. hr.	—	10·13	8·52	7·20	6·17	Including lubricating oil cooling
				Pressures.			
15	Barometer, mm.	761	760	761	760	760	
16	Mean indicated pressure, atm.	(2·38)	3·35	4·23	4·84	5·50	Bracketed values extrapolated
17	Mean effective pressure, atm.	(1·94)	2·91	3·78	4·38	5·05	Bracketed values extrapolated
18	Pressure ratio $\frac{\text{Maximum combustion pressure}}{\text{Compression at beginning}}$	—	45·3	45·7	45·5	45·6	
19	Scavenge air at engine, atm.	0·174	0·179	0·182	0·181	0·180	
				Temperatures.			
20	Air temperature outside, deg. Cent.	3·2	7·1	5·0	5·2	6·0	
21	Engine-room temperature, deg. Cent.	10·8	13·2	16·0	16·2	14·9	
22	Scavenge air temperature :						
	(*a*) Before turbo blower, deg. Cent.	3·2	7·1	5·0	5·2	6·0	
	(*b*) Before the engine, deg. Cent.	25·0	27·4	26·0	26·6	28·0	
23	Exhaust gas temperature, deg. Cent.	156	203	252	288	343	
24	Cooling water temperature :						
	(*a*) Before pump, deg. Cent.	—	6·5	8·5	7·9	7·4	
	(*b*) After engine :						
	(A) Cylinder cooling, deg. Cent.	—	28·0	31·0	34·1	40·5	Including lubricating oil cooling
	(B) Piston cooling, deg. Cent.	—	22·7	26·2	27·9	30·4	Including lubricating oil cooling
				Exhaust Gases.			
25	CO_2 content, per cent.	—	2·3	3·1	3·8	4·4	Observed by Orsat apparatus
	O_2 content, per cent.	—	17·9	16·8	16·0	15·3	Observed by Orsat apparatus
	CO content, per cent.	—	0·0	0·0	0·0	0·0	Observed by Orsat apparatus
	N_2 content, per cent.	—	79·8	80·1	80·2	80·3	Observed by Orsat apparatus
26	Calculated surplus air : $\lambda = \frac{N_2}{N_2 - \frac{79}{21} O_2}$	(9·1)	6·44	4·74	4·01	3·54	
27	Molecular weight, kg./mol.	(29·0)	29·09	29·17	29·25	29·33	
28	Mean specific heat, kcal./kg. deg. Cent.	(0·241)	0·241 (3)	0·241 (8)	0·242 (2)	0·242 (5)	
29	Mean weight of exhaust gas, kg./h.	(85,337)	85,653	85,959	86,203	86,504	
				Heat Balance.			
30	Heat supplied in fuel, 10^6 kcal./h.	7·35	10·51	13·65	15·99	18·98	Lower calorific value of oil H_u = 9971 kcal./kg.
	Heat supplied in fuel, per cent.	100	100	100	100	100	Lower calorific value of oil H_u = 9971 kcal./kg.
31	Heat utilised :						
	(*a*) Effective output Q_n, 10^6 kcal./h.	2·23	3·64	4·91	5·80	6·77	
	Effective output Q_n, per cent.	30·4	34·6	36·0	36·3	35·7	
	(*b*) Cylinder cooling water, 10^6 kcal./h.	(1·03)	1·41	1·88	2·38	3·03	
	Cylinder cooling water, per cent.	(13·0)	13·4	13·8	14·9	15·9	
	(*c*) Piston cooling water, 10^6 kcal./h.	(0·70)	0·946	1·18	1·32	1·52	
	Piston cooling water, per cent.	(9·5)	9·0	8·6	8·3	8·0	
	(*d*) Exhaust gases, 10^6 kcal./h.	(3·0)	4·05	5·13	5·91	7·06	
	Exhaust gases, per cent.	(40·8)	38·5	37·6	36·9	37·2	
	(*e*) Remainder (radiation + conduction losses + errors of observation), per cent.	(5·3)	4·5	4·0	3·6	3·2	
				Efficiencies.			
32	Thermal efficiency assuming no losses $\eta_0 = \frac{A L_0}{H_u}$, per cent.	(60·2)	59·6	58·3	57·6	56·7	Calculated according to Fr. Schmidt's method
33	Indicated thermal efficiency $\eta_t = \frac{632 N_i}{H_u B}$, per cent.	(47·7)	46·5	45·3	44·2	42·3	
34	Indicated efficiency $\eta_i = \frac{\eta_t}{\eta_0}$, per cent.	(79·2)	78·6	77·7	76·7	74·6	
35	Mechanical efficiency $\eta_m = \frac{N_w}{N_i}$, per cent.	(81·2)	86·8	89·3	90·6	91·8	
36	Useful work efficiency $\eta_h = \frac{N_n}{N_w}$, per cent.	78·6	85·9	89·2	90·6	91·9	
37	Total efficiency $\eta_{ges} = \frac{632 N_n}{H_u B} = \eta_0 \eta_i \eta_m \eta_h$, per cent.	30·4	34·6	36·0	36·3	35·7	Compare No. 31*a*

* No. I. appeared June 13th.

mean indicated pressure, as well as the fuel consumption B and the consumptions b_w and b_n in grammes per B.H.P. hour referred to in Table I., along with the guarantee curve which has a 5 per cent. tolerance and is expressed in grammes per B.H.P. hour based on the effective horse-power N_n. It will be seen that the guaranteed fuel consumption was considerably improved upon, the best figure being 174·5 grammes per B.H.P. hour, corresponding to an effective output N_n of 8700 B.H.P. The consumption corresponding to the designed load of 10,700 B.H.P. or 7500 kW was 177·5 grammes per B.H.P. hour. In connection with the fuel consumption above referred to, it may be mentioned that the cooling water taken from the river Havel was very cold, and its temperature of 8 deg. Cent. had a detrimental effect on the running of the engine.

After completing the tests it was decided to couple the inlet and the outlet connections in the water cooling system in such a way that, when in operation, the average cooling water temperature at the inlet was raised to 20 deg. Cent.

By this means the fuel consumption was reduced by 4 grammes per kW hour, which saving has been confirmed by many fuel tests since carried out.

The fuel used was "Diesel oil," which, when tested in the Chemical Laboratory for Commerce and Industry in Berlin, gave the following results :—

Appearance in a 15 mm. layer : Yellow brown, clear, grey green fluorescence similar to mineral oil.	
Specific gravity at 20 deg. Cent.	0·876
Viscosity, Engler, at 20 deg. Cent.	1·27
Flash point in open test	88 deg. Cent.
Water	None
Foreign matter	None
Ash content	0·006 per cent.
Acid oils and phenols	None
Boiling point	197 deg. Cent.
At 305 deg., 90 per cent. distilled, at 327 deg.	95 per cent.

Fundamental Analysis.

Carbon	87·30
Hydrogen	12·17
Sulphur	0·49
Ash (see above)	0·006
Remainder (nitrogen and oxygen)	0·034
Total	100·00 per cent.
Mean higher calorific value	10,628 kcal./kg.
Mean lower calorific value	9,971 kcal./kg.

The theoretical amount of air for the combustion of 1 kilo. of fuel works out according to the above as 14·2 kilos.

The scavenge and charging air was not directly measured, but was calculated from the excess of air shown by the exhaust gas analysis. As a check the characteristic curves of the turbo-blower supplied by the A.E.G. were employed. According to the calculated values, the mean quantity of air delivered was 84,600 kilos. per hour, which compared well with the reading of 85,000 kilos. per hour, given by the curve.

Heat Balance.

The heat balance is given in Table I. and is shown diagrammatically in Figs. 10 and 11, the basis being the useful B.H.P. output N_e. The quantity left over after the main factors are accounted for is, it should be noted, very small. It embodies radiation losses, conduction and errors of observation. The heat passing to the cooling water and the cooling oil includes most of the frictional heat, and the radiation was small as the room temperature was about midway between that of the cooling water inlet and outlet. It will be seen that the heat rejected to the exhaust is larger than that rejected to the cooling water, although the circulating temperature was rather low. The amount of heat usefully employed is 36·4 per cent. under the best load conditions and 34·6 per cent. at half load.

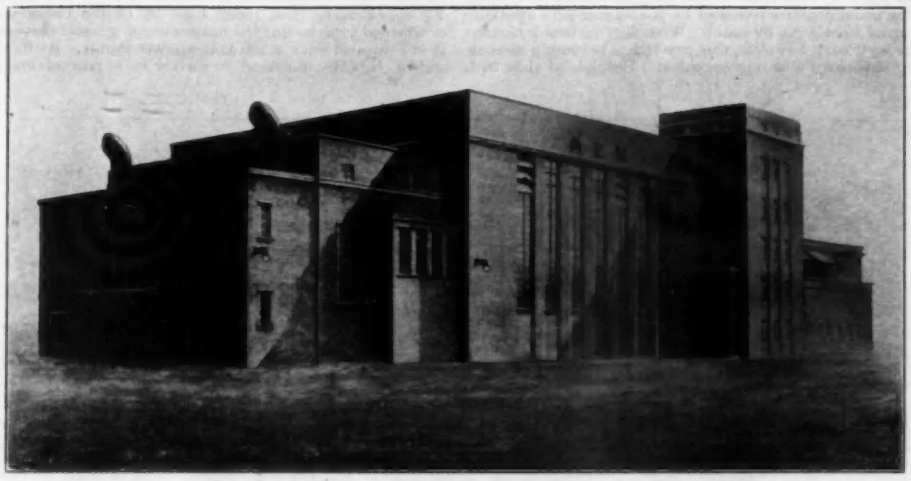


FIG. 8—HENNIGSDORF PEAK LOAD STATION

Efficiency Ratios.

In Fig. 12 the various efficiency ratios are reproduced in the form of curves. They are also referred to at the foot

TABLE II.—*Full Load Measurements.*

	Cylinder.	Indicator diagram.		M.E.P. on I.H.P. basis.	
	No.	Area.	Length.	Atm.	Corrected.
		mm².	mm.		kg/cm².
Top side	1	185	72·6	5·2	5·40
	2	185	72·6	5·2	5·40
	3	185	72·3	5·22	5·42
	4	185	72·5	5·21	5·41
	5	190	72·4	5·36	5·56
	6	187	72·5	5·27	5·47
	7	185	72·2	5·23	5·43
	8	185	71·5	5·28	5·48
	9	190	71·6	5·42	5·62
	10	190	71·8	5·38	5·58
	Mean ..	—	—	5·277	5·49
Bottom side	1	190	72·8	5·32	5·43
	2	197·5	73·6	5·47	5·58
	3	190	73·0	5·31	5·42
	4	185	72·8	5·20	5·30
	5	200	73·0	5·60	5·70
	6	200	73·0	5·60	5·70
	7	198	73·0	5·54	5·65
	8	187·5	72·9	5·23	5·34
	9	187·5	72·2	5·32	5·43
	10	200	73	5·6	5·70
	Mean ..	—	—	5·42	5·52

of Table I., items Nos. 32 to 37. From the values $N_i - N_e$ the mean mechanical loss N_m is obtained, which is shown to be about 1040 B.H.P. Comparative tests, which were made on the test bed at the M.A.N. works, during which the cooled engine was driven electrically, showed an average value of $N_m = 1075$ B.H.P. This close agreement confirms the high mechanical efficiency of 92 per cent. at full load, which is quite comparable with the performance of a steam engine. In order to investigate further the efficiency of the engine Mr. Laudahn worked out the thermal efficiency of the engine, assuming no losses, according to the comparative method of Fr. Schmidt. The curve reproduced in Fig. 9 shows an indicated efficiency N_i at full load of 74·6 per cent., which increases with the smaller loads and is about 80 per cent. at one-third load.

The above refers to the test results obtained from engine No. II., which underwent complete trials. Some points, however, have been introduced in the fuel consumption curves—see Fig. 9—from tests taken on No. I. engine.

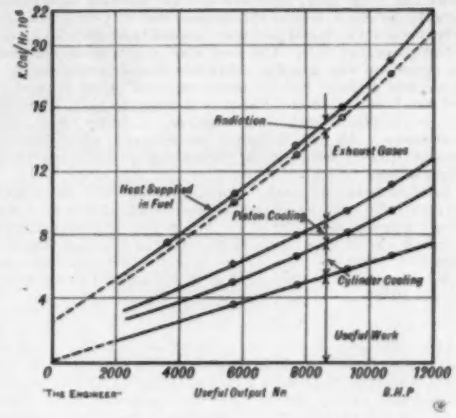


FIG. 10—HEAT BALANCE

This engine was found to have a slightly higher fuel consumption, which is to be explained by the fact that it had been a shorter time in commission and had not been run in to the same extent as engine No. II.

General Running Conditions.

In order to test the starting equipment trials, one after the other, were carried out with two air receivers, each having a capacity of 1200 litres. It was demonstrated that a single charge allowed eighteen starting manœuvres, while at the nineteenth manœuvre the engine refused to start. The pressure in the receivers dropped from 67 to 18 atmospheres during the eighteen manœuvres and the pressure at the air starting valve from 30 to 14 atmospheres. The engine, however, started quite well at 14 atmospheres. With six air receivers there is, it will be seen, an ample margin of starting air.

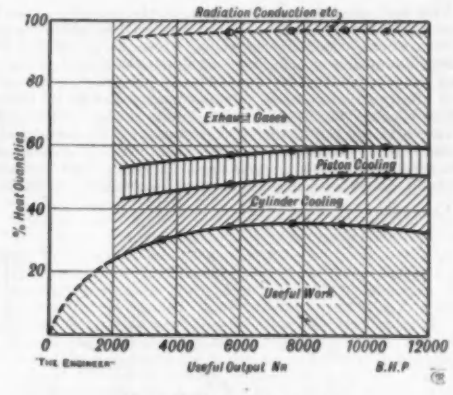


FIG. 11—HEAT BALANCE

In order to test the starting up of the installation without any current from an outside source, such as is usually available, tests without the accumulator battery were carried out. In this trial the engine was run on starting air so long that the turbo-blower received sufficient current for the main generator to drive it at the necessary speed for supplying scavenge air. As soon as the first ignition took place the speed naturally increased and the engine was then ready for more fuel. The power was gradually built up and the cooling water pump was, with the increasing voltage, also slowly brought up to its full output. For this special test three starting receivers were employed. The pressure in the receivers fell from 69 to 42 atmospheres during the test, and the first ignition took place thirty-two seconds after the air was turned on. The starting air was immediately shut off and in a further two minutes and twenty-four seconds the set was run up in parallel and

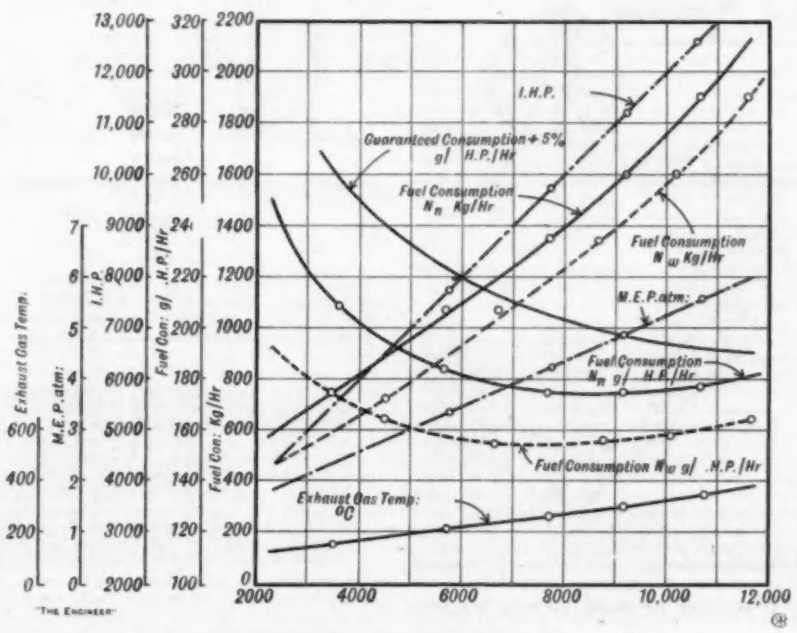


FIG. 9—CURVE FOR NO. II. SET

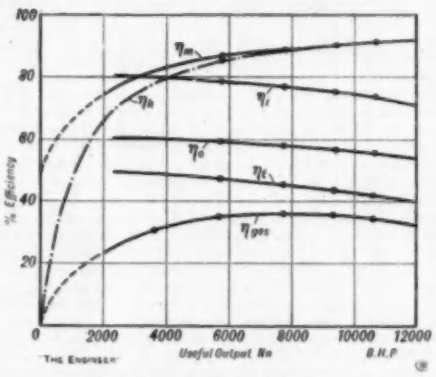


FIG. 12—EFFICIENCY RATIOS

placed on the network. This particular test was carried out without any hurry and no effort to get a quick start was made.

In order to show that one machine running under load could be stopped and the load transferred to the second set, trials were carried out on December 13th, 1929. As the station output is not yet fully utilised it is usual to run one set as a phase regulator and the other at the peak load times of morning, midday and evening previously referred to. Starting the tests at 7.18 p.m., the load from No. II. set, which was running at full load, was transferred to set No. I., which was on service as a phase regulator. After the very short interval of two minutes and three seconds the No. I. engine was started and fifty-two seconds later it was up to speed and was coupled through the clutch to the generator unit. The load was then transferred and the operation was completed five minutes after the starting signal was given. No. II. then ran as a phase regulator and No. I. set on load. For this manœuvre there were in the engine-room only one engineer, a driver and two attendants. All the different movements were carried through quietly without any haste and with no previous preparation.

As regards the dynamic balancing of the sets, the working speed lies well under the critical speed, and there is no danger of torsional vibration. No special measures of the dynamic forces were made at the time of the tests we are describing, but the subject of the dynamic balancing of M.A.N. engines was described in *Schiffbau and Schiffahrt*, No. 30, 1929.

Conclusion.

The airless injection oil engines at the Hennigsdorf peak load station mark an important forward step in the utilisation of oil engines in power stations. The test results summarised in this article bear witness to the high value of the engines for emergency service and their very reliable operation both as regards starting and running. They can be put on load in less than three minutes from receiving the demand for current. The installation is one for which the manufacturing firm which supplied the plant deserves the greatest credit, while the Märkischen Electrizitäts Werke is also to be congratulated on its forward policy, which has enabled this important technical advance to be so successfully undertaken.

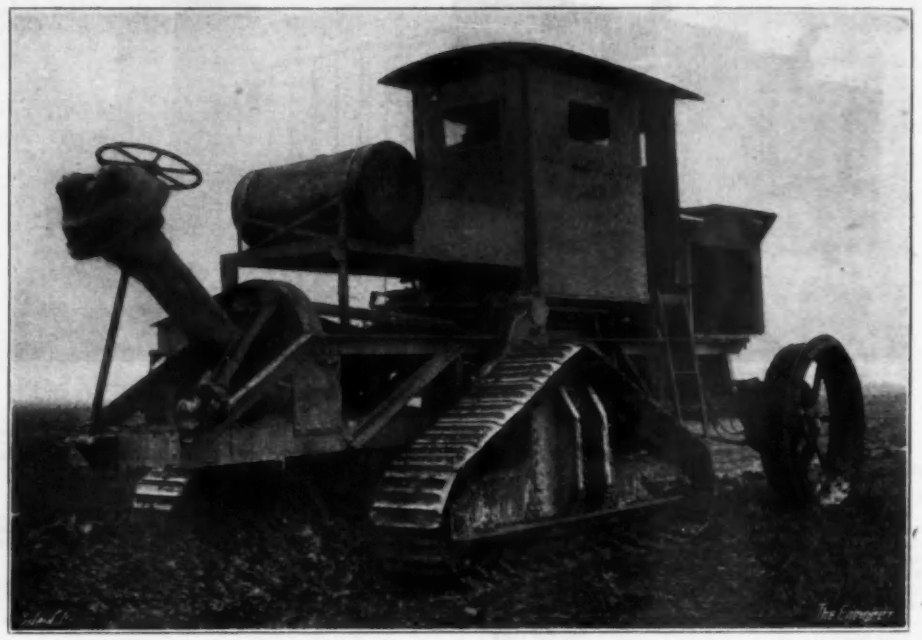
A Land Marling Machine.

The agricultural practice known as the marling of land is of ancient origin and is widely practised in many parts of the world. Marl is the name given to a variety of earths composed of a mixture of chalk and clay. It may also contain measurable quantities of phosphorus, potash and nitrogen compounds. It frequently occurs at some depth beneath the arable surface layer of farm lands and is employed by the farmer as a dressing for his fields with usually great advantage to his crops. It has a distinct manurial value and, in addition, on boggy and certain other lands, its intermixture with the surface layer effects a marked improvement in the texture and mechanical properties of the soil.

In Great Britain opportunities for the marling of the soil occur in those geological regions which belong to the recent and pleistocene formations. There are few or none of those regions in Scotland or Ireland, but in England there is a large area in the shires of Cambridge, Norfolk and Lincoln—the Fenland round the Wash—of which the formation is suitable for the practice of marling. A considerable area also is found in the West Riding of Yorkshire and a smaller portion in the East Riding, along the valley of the river Hull. The Romney Marsh, in Kent, is of the requisite formation and several small isolated areas occur in Essex and in the neighbourhood of Bristol.

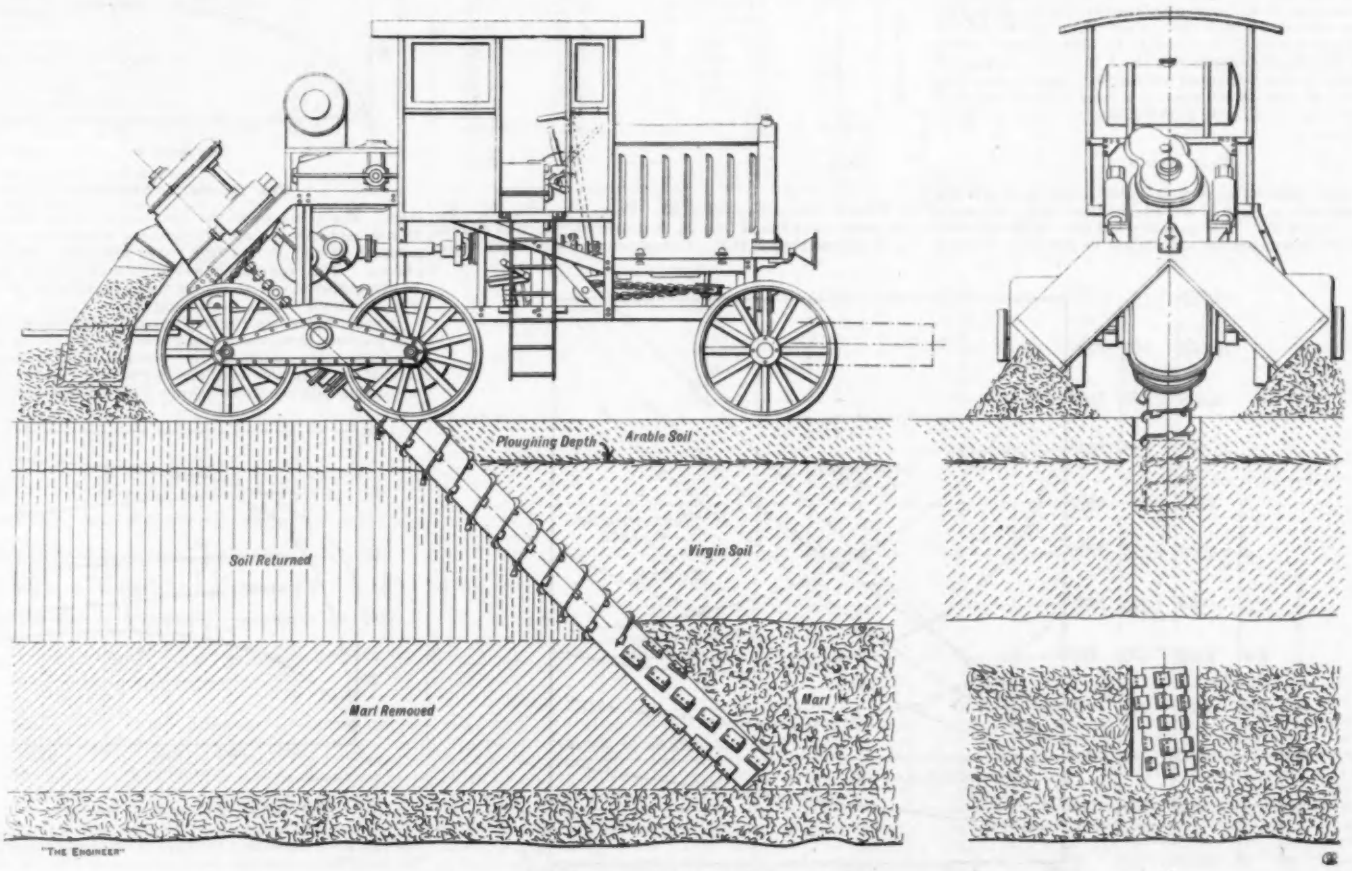
The usual practice followed by the farmer is to excavate the marl from a pit by hand. With agricultural labour at its present cost, however, this practice is becoming increasingly expensive and uneconomical. Because of that fact, efforts have been directed towards the production of a machine which would perform the excavating work in an improved manner. A simple excavating machine would, doubtlessly, serve the purpose, but it would suffer from the disadvantage that it would deliver the marl at one point, from which it would require to be carted over the fields. In addition, an excavating machine of the ordinary type would involve the formation of a pit of increasing depth or area, which, for arable purposes, would represent so much wasted land. The ideal procedure is clearly to bring up the marl from beneath each field by traversing it with one or more trenches, the surface layer and subsoil being restored to the trenches after the marl is removed from below. Each field would then provide its own marl, no portion of the land would be lost to cultivation and the marl would be delivered as a bank, the spreading of which would involve a greatly reduced amount of labour.

To marl land by such a trenching method would, if the work were done by hand, be so expensive of labour as to make the process quite unprofitable. It is quite otherwise, however, if a machine is employed for the purpose. Such a machine has been produced in Germany where there are large areas of agricultural land which are suitable for marling. The machine is illustrated in the accompanying engravings. The truck may be of the chain track or wheeled type to suit the nature of the ground traversed. It is equipped with a 100 horse-power motor. At its rear end a tube is mounted to swivel in a pair of bracket bearings. Inside this tube there is a conveyor screw. Externally the tube is provided with a series of cutters lying on a spiral passing round the upper portion of the tube length. At its lower end the tube is fitted externally with a number of closely spaced cutters. The upper set of cutters works in the surface and subsoil layers. The lower set operates in the layer of marl.



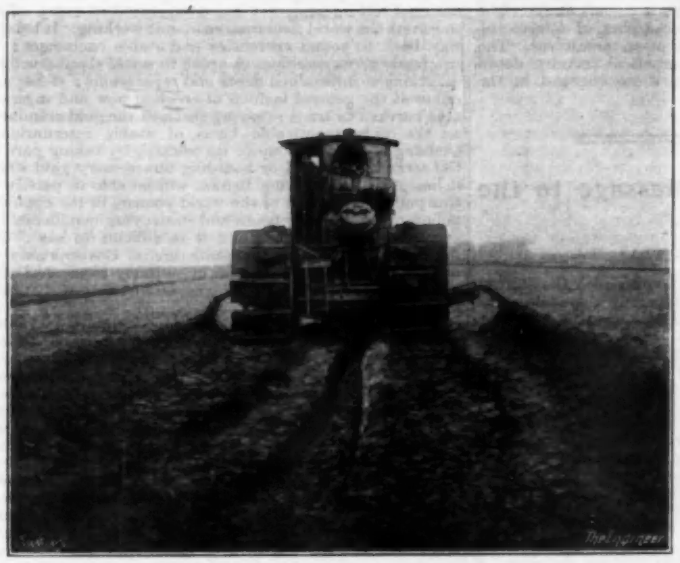
Marl-Lifting Machine with Chain-Track Truck

For transport purposes, the tube is swung horizontally beneath the truck. When the field to be marled is reached, the nose of the tube is lowered on to the ground, the tube is set rotating and the truck is driven slowly forward. The tube bores its way into the ground and, as the truck advances, turns on the swivel bearings at its top end and increases its inclination. The nose of the tube is in this way caused to penetrate deeper and deeper into the ground. When the layer of marl is reached, the tube is locked in the inclined position which it has reached. Its rotation and the slow forward movement of the truck are continued



Mode of Operation of Marl-Lifting Machine

LAND MARLING MACHINE AT WORK



and the elevator screw inside the tube is set into motion. The marl loosened by the cutters at the lower end of the tube is lifted by the elevator screw to the top end, where it is delivered through holes into a pair of shoots from which it flows on to the land in the form of two continuous banks. The arable surface layer and sub-soil are loosened sufficiently to permit the tube to pass forward through the land, but they are not otherwise disturbed except in so far that they descend downwards to the extent required to make good the space previously occupied by the marl that has been lifted. As the machine passes over the land it leaves behind it two banks of marl and between them a depression in the soil about a foot deep. When the limit of the field is reached the forward movement of the truck and the motion of the elevator screw are stopped and the tube still rotating is gradually raised out of the ground by turning it on its swivel bearings.

In average soil the machine is advanced at a rate of about 6ft. per minute, and is claimed to be able to lift 50 to 80 tons of marl per hour from a depth of 8ft. to 10ft. The machine is not one which could be extensively acquired by individual farmers. In Germany about 35 machines are owned and operated by a large contracting firm which undertakes the treatment of the land by contract with the owners or farmers. The charge for the treatment is based on the volume of marl lifted. Exclusive of the cost of spreading the marl after it has been raised the charge works out, on the average, at £8 or £10 an acre. It is claimed that the benefits derived from marling with the machine persist for 20 years or more. These benefits may mean as much as a 30 or 40 per cent. increase in the crop yield. They are derived principally from the manurial value of the deep-lying layers of marl, but are also in part to be ascribed to the improvement of the soil texture and the enhanced subsoil drainage resulting from the cutting of a hidden trench in the marl.

A demonstration of the machine was given this week at Ouse Bridge Farm, Fordham, Norfolk, by Agricultural and General Engineers, Ltd., of London. If British farmers cultivating fenlands and moorlands are prepared to give adequate support, it is the intention to manufacture the machines in this country and to place their operation in the hands of a contracting company, which would undertake the work at a fixed cost per acre.

The Foundrymen's Convention at Middlesbrough.

No. II. (*Conclusion*).*

QUITE a number of engineering institutions nowadays arrange their annual meetings to consist solely of a series of visits to works and cut out the reading and discussion of papers altogether. The Council of the Institute of British Foundrymen, however, this year organised a happy compromise, inasmuch as there were not only a number of papers, but also enough visits to works to satisfy the most inquiring minds. In order, however, to get the reading of the papers completed at morning sessions on the two days allotted to the business part of the Conference, it was necessary to hold duplicate sessions on June 18th and 19th. In all, there were ten papers, but as some of them were what are known as exchange papers and were by foreign authors who were not present, some were presented and not discussed, and others were merely received and will go into the official "Proceedings" as part of the Conference.

A paper presented on behalf of the American Foundrymen's Association dealt with the briquetting of cast iron borings, the author being Mr. Fred J. Walls, who is chief metallurgist to the Wilson Foundry and Machine Company, Pontiac, Michigan. A great many methods have been devised during the past decade for binding together borings or chips in order that they may be used economically as melting scrap in the cupola. These methods include the rusting process, using common salt, sal-ammoniac, &c., the cementing process, using waterglass, Portland cement, and other binders, and the canning process by sealing in sheet metal containers. The author points out, however, that few, if any, of these methods have proved very successful on account of the cost of materials and labour involved and also owing to the excessive oxidation losses encountered in the high-temperature zones within the cupola. The paper describes a machine developed in America and installed in a number of large motor car and other factories there consisting of an automatic semi-hydraulic press capable of exerting a pressure of 600,000 lb. for briquetting cast iron borings. As this machine afforded a means of considerable saving as between the selling these borings at the prevailing market prices and the purchase price of cast scrap or pig iron, the results were watched in America very keenly. The conclusion arrived at after experience with one of these machines installed in the author's company's works is that the question whether or not briquetted cast iron borings can be used successfully in the cupola resolves itself into one of economics. Experience shows that there is no detrimental effect on the quality of the metal itself nor in the percentage of good castings produced when using up to 20 per cent of borings in the mixture.

Mr. C. H. Ridsdale and Mr. N. D. Ridsdale discussed in some detail "The Economic Utilisation of British Pig Iron Resources." Not the least interesting feature of the paper was a series of tables giving full characteristics of the various pig irons obtainable in the British Isles, the avowed object being to give the foundryman information which will enable him to select varied brands of iron for his own particular purpose, but at the same time using iron produced as near his own locality as possible. To that extent, therefore, the paper may be regarded as a compilation of extremely valuable information on a matter concerning which remarkably little appears to exist, at any rate in an easily accessible form. The authors are consulting metallurgists and chemists and fearing that they might be placed in a difficult position were they to publish information coming into their possession in their professional capacity, they decided to send a circular letter to all makers of pig iron in the country asking for the latest information. That information forms the burden of the paper. Even so, it does not claim to be thoroughly complete, because some makers have either not supplied any information at all or not such complete details as were asked for. Nevertheless, the paper forms an admirable work of reference from the point of view from which it was written, the object behind it being to encourage co-operation between the foundryman and the ironmaker with the object of improving the quality of castings generally.

Mr. J. E. Fletcher (Consultant to the British Cast Iron Research Association) said that in the Cleveland area one of the most remarkable series of pig irons the world had ever known had been manufactured for many years, and for many years its reliability had been unequalled. The recent tendency to displace natural pig irons by mixtures of steel and pig iron presented a problem which was occupying the minds of foundrymen, especially those who were called upon to make high-duty irons demanding something which Cleveland pig iron did not contain. Experience had shown that there were some dangers connected with the use of mixtures of steel and certain kinds of all-mined pig iron. Some furnaces which had for many years made ideal pig irons were going out of action because the types of pig iron they were producing were being ousted by other products which contained steel. Many foundrymen were in difficulties because they could not get the ideal pig irons produced previously and had to try to imitate them by so-called refining and by using mixtures of iron and steel. It was worth while considering very closely whether they should encourage blast-furnace men to make irons having analyses very close to those of the castings desired or whether the iron producers' trade should be spoiled by using something else which was not all users would like it to be.

The founding of bronze gear blanks was the subject of a paper, by Mr. Francis W. Rowe, which was based on the experience obtained in the foundries and laboratories of David Brown and Sons, Ltd., the gear specialists of Huddersfield, and was, of course, published by permission of the firm. The founding of bronze gear blanks presents various problems not encountered generally in other types of foundry work and the paper sets out a few of them. Much of the greatly improved performance of spiral or worm gears in recent years has been due to the use of bronze, the quality of the material having been vastly improved by metallurgical research and manufacturing methods. In practice, the material actually used by various manufacturers for such gears does not vary very widely in chemical composition, being usually a straight tin phosphorus-bronze with from 10·5 to 13 per cent. tin and 0·1 to 0·5 per cent. phosphorus. Such a bronze, consisting largely of alpha-delta eutectoid, embedded in a matrix of copper-tin alpha solid solution, has that type of structure which has been found by experience to be best where sliding friction has to be encountered. Some useful information is given concerning foundry operations, and it is interesting to note that the centrifugal method of casting is adopted for all work up to 18in. diameter. Above that diameter, the number of castings required determines the method of casting, there being no real limitations except economic ones to the centrifugal process being adapted to blanks larger even than 3ft. With this proviso, it may be said that centrifugal casting has only so far been adapted to castings up to 36in. diameter, and approximately 500 lb. in weight. Since 1927, when the production of centrifugal castings was first commenced on a large commercial basis, sufficient experience has been accumulated to demonstrate the superiority of this class of casting over sand and chill casting in increased load-carrying capacity, greater durability and general freedom from service failures. As an indication that progress is still being made, however, the author expressed his inability to include in the paper a description of a further important innovation in the founding of gear blanks owing to the fact that the method has not yet reached the fully commercialised stage of development which would justify publication.

"The Future of the Side-blown Converter in the Steel Foundry," by J. Deschamps, pointed out that for a given temperature side-blown converter steel has a greater fluidity than steel made by any other method, this resulting in appreciable economies in refractories and in the amount of steel to be used in feeding heads. This remarkable fluidity facilitates the action of the alloys employed in the converter and in the ladle to deoxidise the steel, and it enables the products of the deoxidation to pass readily into the slag. Thus, although from the very nature of the process, converter steel contains originally more oxides, occluded gases and silicate inclusions than open-hearth or electric steels, its greater fluidity renders easier the elimination of these impurities. The converter process has also the advantage over the open-hearth and the electric process of much greater flexibility. In a well-organised plant, consisting, for instance, of two cupolas of 6 tons per hour each, each one being capable of feeding three converters of 30 cwt. each, it is possible regularly to obtain 1½ tons of steel every 15 minutes, or, if need be, in exceptional cases, six converters can be blown together and yield at a given moment 9 tons of steel. Steel is always available to pour into moulds and the best use is thereby made of the casters and the men handling ladles. Recent developments in the "cupola-converter" process of steel making have shown the possibility of producing in side-blown converters of, say, 1½ tons capacity—from a metallic charge in the cupola consisting of 70 per cent. low P steel scrap and 30 per cent. high silicon, low phosphorous hematite pig iron, melted with 10 per cent. melting coke, the heat being blown in the converter in about 20 minutes—a steel of, say, C 0·15, Si 0·3, Mn 0·6, S 0·03 and P 0·04 per cent., which, after standard annealing, will give 30 tons per square inch tensile, associated with 55 per cent. reduction in area and 38 per cent. elongation, and a cold-bend test of 180 deg. without fracture. The author contends that such good physical properties are only rarely obtained by open hearth or acid electric steels, and even if they can be expected from well-made basic electric steel, it is at a cost much greater than that of converter steel. With low phosphorous hematite iron at 90s. per ton, low-phosphorous steel scrap at 60s. per ton, good cupola coke at 45s. per ton, electric power at 1d. per unit and labour at about £3 per man per week, 1 ton of finished steel in the ladle can be produced at about £6 from 30 cwt. converters. Whilst cheaper than electric steel, converter steel is more expensive than open-hearth steel, but converter steel has the considerable advantage of a much greater

* No. I. appeared June 20th.

flexibility. The most important factors determining the installation of a converter plant are set out as :—(1) Availability of cheap and plentiful steel scrap reasonably low in phosphorus, and (2) class of castings to be produced. In a general steel foundry which has to make at the same time small, intricate castings on a semi-repetition basis, and plain, heavy castings, the ideal plant would consist of a basic-lined open-hearth furnace and a battery of semi-blown converters.

Discussing the economic use of compressed air in steel foundry practice, Mr. T. W. Barley stressed the following points :—(1) Whenever possible put down a central station and install high-class compressors built to a guaranteed output of compressed air for a given input of power under test ; (2) fit up volume and pressure recorders for the air and power recorders for the prime movers, take daily readings and schedule them for ready and rapid comparison and, above all, make use of the figures ; (3) assure the compressor attendants that they have a worthwhile job and that the management considers it as such ; (4) keep the tools efficient by proper maintenance and testing at regular intervals ; (5) test for leaks periodically and when shown on instruments do not rest until they are found and rectified ; (6) do not permit waste of air by misuse, it is too expensive to use for dusting down cranes, even if it saves the crane operator's time ; (7) do not buy cheap oil for the compressors, the consumption will be so much more at the end of the year, it will have cost as much and not given equal results obtained with the high-grade oil ; (8) pay close attention to the compressor valves and the moving parts of the air tools.

The problem of training foundrymen in the technique of their work has long been a difficult one, very largely owing to the fact that the foundry has not been looked on with favour, even by foundrymen themselves, as affording a trade to their sons. Attempts at running evening classes in various parts have not altogether been successful, but a change has been noticed in more recent years owing to the fact that the foundry managers themselves have taken a hand in seeing to it that the boys engaged in the foundry are given training of the kind required to improve their work and fit them for higher positions. Under the influence of the Institute of British Foundrymen a Foundry Advisory Committee has been formed. Its object is to devise a scheme of technical training for young foundrymen in the Teesside area. The following firms have entered into the scheme by appointing representatives on this Committee :—The Anderston Foundry Company, Ltd., Port Clarence ; Ashmore, Benson, Pease and Co., Ltd., Stockton ; Bolckow, Vaughan and Co., Ltd., Middlesbrough ; the British Chilled Roll and Engineering Company, Ltd., Haverton Hill ; Cochran and Co., Ltd., Middlesbrough ; Dorman, Long and Co., Ltd., Middlesbrough ; Head, Wrightson and Co., Ltd., Thornaby ; and Pease and Partners, Ltd., Middlesbrough. In addition, the Committee will contain one representative from the local section of the Institute, two representatives from the College Governing Council, two representatives from the College staff, and, *ex officio*, the Principal of the Constantine College and the Director of Education.

Mr. Douglas H. Ingall, Principal of the Constantine College, referred to last week, described in a paper how this stage has been arrived at and how the scheme has been put into operation with some seventy students, who have been selected by their firms. The scheme is frankly experimental. It is an evening class one mainly, but Dr. Ingall expresses the view that there is need in this country for a full-time day course for the foundry industry for those hoping to reach the higher positions. In this connection a Special Advisory Committee has been constituted consisting of representatives of the Institute of British Foundrymen, the Iron and Steel Institute, the Institute of Metals, the British Cast Iron Research Association, and the local Foundry Advisory Committee previously referred to. Actually the Middlesbrough Education Committee has decided to appoint a full-time instructor, and such a course will be given at the Constantine Technical College next September.

In the course of the discussion on this paper Mr. J. H. Smeaton offered to bear the expense of sending six students each year for five years to spend three months in German foundries during their vacations.

Mr. Frank Hudson read a paper in which he puts the case for the reclamation of oil-sand cores. At the present time one of the points militating against the universal adoption of oil-sand cores is the cost increase over ordinary moulding sand mixtures. Most foundries realise that the benefits accruing from the use of oil-sand cores more than fully compensates for their increased cost, but competitive conditions are holding back its use. The common complaint is against the inability to re-use the old core sand or to dispose of it, but it is pointed out that few foundries are fully alive to the value of reclaiming this material. Although core sand reclamation is practised in one or two cases here and also in America, the author expresses the view that even in the United States, where sand reclamation is the general rule, the reclaimed oil sand has not yet been successfully employed for cores, although large quantities of it are used to make up synthetic moulding sand. Very little oil-sand reclamation is practised in the British Isles, the outstanding example being found in the works of Morris Motors, Ltd., of Coventry. Other foundries in the Midlands are incorporating a definite proportion of used core sand in their standard mixtures, but in every case the binder employed contains cereal matter.

As to the benefits arising from reclaimed oil-sand cores, these must be considered in relation to each particular foundry. The points to be considered are (1) initial cost of core sand, (2) amount of oil-sand cores used, (3) cost and kind of binder used, (4) nature of the metal used for casting, (5) cost of disposal of waste sand, and (6) existing plant layout and type of castings made. Careful considera on of these points will enable a foundry to decide upon what method of reclamation to employ, as obviously sand can be reclaimed by very simple means or by the use of special equipment. The special benefits arising from the use of reclaimed oil sand were stated as (1) it is possible to obtain a uniform sand free from gas so that cores having maximum natural permeability, and (2) in certain instances a substantial saving can be made in binder costs.

Another paper to which some reference should be made was that by Mr. W. Scott, which dealt with "The Production of Large and Medium-sized High-class Iron Castings." It described some of the methods adopted by Sir W. G. Armstrong, Whitworth and Co. (Ironfounders), Ltd., in the production of large turbine and oil engine castings. A feature of the paper was the emphasis laid upon the need for the very highest class of men to be engaged upon this work, it being pointed out that even with sound foundry supervision the supply of the right materials at the right time and the prevention of overlapping of effort, the remainder depends upon the craftsmen themselves. The paper contains a great deal of practical foundry detail which will be found valuable to those engaged in the manufacture of large castings.

British Industry's Message to the World.*

By PROFESSOR HENRY CLAY, M.A.

You will not expect a student to approach the subject of this afternoon's session from precisely the same point of view as the leading industrialist who has just addressed you. In study it is easier to look backwards than to look forward. The administrator is properly concerned with the future, because he is making it ; the student cannot hope to do more than draw one or two morals or lessons from a careful survey of past experience.

From this point of view the contribution of British industry to the world is clear. Britain was, as a matter of bare historical fact, the pioneer of modern industry ; and British industry, by pioneering modern industrial methods, has done more to knit together the countries of the world into a single economic system than any other force. May I elaborate this and show its bearing on the present situation ?

The industrial methods that this country developed a century and a century and a half ago—the methods of large-scale capitalist enterprise—has grown and spread until they are the common methods of every industrial country. In the early stages they were actually introduced to other countries by British enterprise ; in the newer countries more particularly the modernisation of the economic system has been largely financed by British capital. The actual physical links that have opened up continents and brought together the ends of the earth—the railways, cables, and shipping services—were very largely forged by British industry and British enterprise. Still more influential have been British commerce and British finance. Britain was the first great exporting nation and remains the greatest. Her exports penetrated the East, broke down the isolation of China and Japan, and opened up Africa. In exchange, her imports brought every country with anything to sell into a world market. London, the commercial centre of the greatest trading nation and the greatest market of capital, became the natural centre in which to negotiate and finance the commercial exchanges of the world. On the eve of the war the world was an economic unity to a greater extent than at any previous period in history ; and the making of this unity, the bringing together in a network of reciprocal commercial and financial relations, was mainly the work of British traders, British engineers, British merchant bankers, and British industrialists.

It followed necessarily that British economic interests were bound up with world prosperity to an extent that no other country had experience of. Doing half the world's shipping, three-quarters of the world's export trade in cotton manufactures, the greater part of the world's foreign exchange business, with an extensive trade with every country and investments in most, we were exposed to the influence of every shock that affected any part of the world. Before the war this did not seriously trouble us ; the very extent and spread of our interests was an effective hedge or insurance against risk. But a world war was a risk that no hedge would provide against. So widespread an interruption and dislocation of normal industrial work and normal trade relations was bound to affect this country more than any other, and affect it adversely.

This is the root explanation of the post-war depression in British industry. The dislocation of established connections is far more serious—paradoxical as it may seem—than the physical destruction of plant and buildings. If you want evidence of this, look at the astounding prosperity of devastated France and compare it with the unemployment in undevastated England or Germany. While we were occupied in the war our established markets were invaded ; while British industry was engaged in meeting the demand for munitions, native industries were growing rapidly in our best markets. Before the war there were markets which did not know—by experience at any rate—that cotton manufactures could be got from any country except Britain ; during the war they found, not only that they could be got elsewhere, but that they could be got cheaper. The after effects of the war were as important as the actual interruption and diversion of trade by the war. The peace treaties added 20,000 miles to the tariff frontiers of Europe. The nationalist feeling excited by the war led to a general raising of trade barriers. Our best markets—inside the Empire, such as Australia and India, as well as outside—were among the leaders in the movement.

I have not time to elaborate the more obvious effects of the war—the actual destruction of wealth and impoverishment of Europe ; the diversion of industrial resources to the transient demands of munitions production. Consider only these two things together ; Britain had by a century's development linked up her trade and industry with the trade and industry of the world ; and the war had broken the links and shaken the foundations on which this trade rested. In consequence industry had two great adjustments to make—to turn back again into the channels of normal demand the workers and other resources that were diverted to the production of munitions ; and to find new outlets to take the place of those that had been closed by the changes in world trade that the war brought about. Such an adjustment can hardly be effected in less than a generation.

I have dwelt at some length on the shock and dislocation caused to British industry by the war—far greater than the loss caused to any other country's industry—because it is only when the difficulties are realised that the post-war achievements of British industry can be appreciated.

In the first place, this country has preserved a sense of responsibility towards the rest of the world. It has not looked at everything from the standpoint of the narrowest national self-interest, but has co-operated in every effort to restore the world to normal economic working. It led the way back to sound currencies and stable exchanges ; it has made great sacrifices in order to settle the disturbing questions of inter-allied debts and reparations ; it has not followed the general fashion of erecting new and insuperable barriers to trade ; having restored the gold standard, as the only practicable basis of stable international exchanges, it has not upset its working by taking part in the scramble for gold or hoarding unnecessary gold when it has got it. How long Britain will be able to persist in this policy, if the rest of the world persists in the opposite policy of obstructing trade and destroying confidence by constant tariff manipulation, it is difficult to say ; the American Senate and the protectionist Governments of our own Dominions are much more likely to convert this country to protection than any domestic advocates of that policy.

In the second place, British industry showed remarkable adaptability and resilience in restoring to normal peacetime employment the hundreds of thousands of workers who had been side-tracked into the blind alley of munitions employment. Between 1914 and 1920 more than three-quarters of the total increase in the occupied male population was drawn into the limited group of metal and engineering industries. By 1925 virtually the whole of this excess had been corrected. Partly by the development of new industries, such as motor manufacture and electrical engineering, partly by transfer to other industries altogether, the great mass of unemployed left in these industries by the war had been drained away. Even more creditable was the way in which the explosives industries faced the problem with which the cessation of war left them.

Next, I would draw your attention to the world position of some of the depressed industries. England is exceptional, not in the depression of its textile and heavy industries, but only in the extent of its dependence on them. If you took those districts of the United States which are dependent on textiles, coal and agriculture, to the exclusion of the rest of the country any time in the last nine years, you would have a picture of depression at least equal to ours. By comparison with other countries we have not done badly. Cotton is depressed ; it has lost ground in the world's markets ; but Lancashire still exports as great a value of cotton manufactures as all the other cotton manufacturing countries put together. Shipbuilding is depressed, with an unemployment percentage that baffles the local administrators of the shipbuilding areas ; but it continues to do about half the tonnage of the whole world, and that without the aid of subsidies or other Government assistance. The coal industry has reduced its cost by more than a quarter in the last three years. The Postmaster-General the other day was boasting of a reduction in the working expenses of his department by £400,000 a year, and asked why the cotton trade, the coal, iron and steel trades failed to carry through a reconstruction which the Post Office could carry through. There is not one of these industries which has not effected a far greater proportionate reduction in its costs of production, not one of them which is not supplying the public with its product at a price much nearer tha pre-war price than the Post Office.

Even more direct evidence of the vitality of British industry is the growth of new industries. There seems to be a common impression that industries never declined before the war, and there is no possibility of industry expanding now unless the depressed industries recover. In fact, the history of British industry is very largely a history of declining industries, lost markets, exhausted fields, compensated, and more than compensated, by new industries, new markets, new fields of enterprise. The need for this re-direction of industry is greater now, because the war interrupted it ; and it is taking place. For illustration I need only mention the industry which Sir Eric Geddes directs, which, if not new, has grown out of recognition ; the enormous development of the electrical industries, the expansion in new directions of the chemical industries, the reorganisation of the cement and many of the minor building material industries, and the establishment as large industries of such things as artificial silk, stainless steel, asbestos, and some of the non-ferrous metals.

Now, these new industries have an advantage over the older-established industries which perhaps helps to explain their comparative prosperity. Just because they are new they have been able to avail themselves of the newest methods of organisation. They have not been hampered by vested interests and obsolete traditions, with the result that their organisation has been rational, not—as in the case of some of the older industries—the haphazard outcome of a century of historical growth. The example which they offer to the older industries is an example of the advantages of rationalisation. I use this word in the most literal, which I believe to be the most important, sense. The rationalisation that British industry needs—and, I am glad to say, has begun to achieve—is not merely a merging of smaller into larger units ; that may be necessary, but equally there are cases where it may not—nor a reorganisation of capital and writing down of assets to a figure corresponding with their true value ; that again may or may not be necessary—nor the introduction of scientific management, or new equipment, or any other single improvement. The rationalisation that is needed is a reorganisation of each industry along the lines that a critical and scientific examination of that industry shows to be rational ; the substitution of such a rational organisation for the haphazard growth and accidental relations which a century of development have left us with. No two industries have identical technical and market conditions ; to impose an identical organisation on different industries would therefore be irrational. But certain needs are common to the depressed industries—the removal of a load of debt, the provision of new capital, larger units, more co-operation, a comparative study of methods to discover and apply the best available methods.

That so much requires to be done in the way of reorganisation is not altogether a matter for discouragement. We have leeway to make up ; but the fundamental advan-

* Sixth Annual Advertising Convention, Hastings, 1930, Industrial Press Section.

tages that made us prosperous before the war—the quality of our population, the advantages of our geographical position, our world-wide connections, our long experience—we still possess, and they will tell again when we have reorganised the use of them.

American Engineering News.

Research in Steel Metallurgy.

FOR economy and efficiency in steel production one much-needed line of development is thought to be in a broader and deeper study of the various factors. Thus the operation of a blast-furnace is highly complicated, and there is insufficient knowledge as to what reactions take place. One very important step has been made, however, in the study of furnace slags, which has enabled the blast-furnace department to provide a more uniform raw material for the open-hearth department. In this study of complex slag mixtures, the characteristics of which cannot be determined by ordinary analysis, the mineralogical composition has been worked out into methods of calculation which permit the composition to be determined as mixtures of compounds, rather than as a gross chemical mixture. In open-hearth work the question of scrap and its influence is a difficult problem, as its quality is becoming more and more uncertain, and even with what is supposed to be good scrap the results are quite uncertain. Increased mixture of alloy metal in scrap is one difficulty, the main source of trouble apparently being copper, nickel and chrome. Automobile scrap contains contaminations of lead, tin, zinc and copper. In the blast-furnace, again, the character of the iron may vary from cast to cast, and even in a single cast, indicating some radical but unknown change in the furnace condition, while all the iron goes to the open hearth as of a certain average analysis. The quality and effect of coke is mainly a matter of judgment or intuition, and there is need for some more definite and scientific determination. With the known variations in quality of iron it is unreasonable to assume that good steel can be made from all kinds of iron. There is evidently need for determining more fundamental data which will eliminate guesswork and empirical methods. The chemical and metallurgical staffs may seek to develop practical working tests which will enable the mills to predict the quality of the steel they are producing.

A Prophecy of Steel and Iron.

A review of possible conditions in the iron and steel industry of a somewhat distant future, as suggested by past and prospective developments, was the rather unusual subject of a paper presented recently before the Mining and Metallurgical Engineers. At present this industry gives employment to nearly a million people, pays £280,000,000 annually in wages and salaries, has an investment of £3,000,000,000, mines 70 million tons of ore, 15 million tons of limestone, and 120 million tons of coal, and produces 40,000,000 gross tons of pig iron and 50,000,000 tons of steel ingots. It includes ownership and operation of railways, steamship lines, and cement, coke, gas and other plants. The supply of ore is practically inexhaustible. Naturally the richer, purer ores, cheaply mined and geographically accessible, will be used as long as they last and are sufficient for other generations. But after them are vast quantities of lower-grade ores, less easily accessible. The limestone and coal reserves are sufficient for many generations. Concrete, timber and clay products have been competing with iron for many years, but there seems no possibility of their supplanting it in many important applications. While steel has been replaced in certain directions by concrete, that is probably balanced by the enormous consumption in the motor vehicle industry. The non-ferrous metals do not promise any serious competition with iron, on account of their relatively small quantities and higher prices. On the other hand, the production of alloy steel is likely to increase greatly. In 1909 there was 1 ton of alloy steel to 132 tons of total steel, while in 1928 the rate was 1 to 16. As far as can be seen there are no factors which seriously threaten the future growth of the industry. But the industry needs more research and development work, together with aggressive and intelligent exploitation of iron and its various and wonderful alloys.

An Exhibition Locomotive.

An unusual development in locomotive construction is the building of a large and powerful engine to the order of a company manufacturing roller bearings, the engine having all its axle bearings of that type in order to demonstrate their practicability, efficiency and economy. For such demonstration the engine will be operated in trial and regular service on different railways. Roller bearings are already in extensive use on passenger cars of all kinds, but the complete equipment of a locomotive is a rather new departure. In addition to that, the owning company had the engine equipped with some fifty modern devices and appliances, such as mechanical stokers, booster engines, feed-water heaters, a steam dryer, fire-box syphons, tube cleaners, and automatic train control for regulating speed in accordance with signal indications. Nickel steel plates are used for the boiler, and the tender has a cast steel frame. The locomotive is of the 4–8–4 type with a booster engine on the trailing bogie and the tender is mounted on six-wheel bogies. The engine has cylinders 27in. by 30in., 73in. driving wheels, 36in. wheels on the leading bogie and 41in. and 36in. wheels on the trailing bogie. The boiler carries 250 lb. pressure and has 7257 square feet of heating surface, with a fire-box of 88 square feet grate area. The weight on the driving wheels is 130 tons, or an average of nearly 33 tons per axle. The total engine weight is 205 tons, or 350 tons including the tender, which carries 14,200 gallons of water and 20 tons of coal. A maximum speed of 85 miles an hour has been maintained. It is estimated that an engine of this class, fully equipped with roller bearings, should be able to start a train some 200 tons heavier than could be started by a similar engine having the ordinary type of bearings.

New Port Facilities.

Extensive harbour improvements have been carried out at Baltimore, under the direction of the Port Development Commission, at a total cost of about £1,700,000. They include 3820ft. of berthing space, 12 acres of storage space, 5 miles of railway tracks, 3 miles of paved 18ft. roadway, 28,000 square yards of paved driveway areas, and four main buildings. These buildings, two storeys high, are built on the shipping piers; they are 1000ft. by 160ft., 600ft. by 90ft., 920ft. by 130ft., and 550ft. by 90ft. They provide storage space for approximately 150,000 tons of freight. Each building has four elevators or lifts of 10 tons capacity, with 12ft. by 26ft. platforms, and eight 4-ton elevators, 10ft. by 12ft. Spiral chutes provide for transporting package freight from the upper floors by gravity. Three of the pier buildings also have landing platforms at the upper floor so that freight can be transferred directly to and from vessels. Bridges across the pier connect the upper floors of the buildings along each side. Two of the piers have double-track railway lines running longitudinally through the buildings, the tracks being depressed so that the floors of the cars are level with the first floor of the building. To prevent smoke trouble when steam locomotives are used, ventilator tubes over the track space are carried up through the upper storey and extend above the roof, where they are fitted with ventilator cowls. Lift bridges at intervals provide for crossing the depressed tracks. For weighing railway cars there is a track scale or railway weighing machine of 100 tons capacity, while wagons or motor trucks are weighed on a 20-ton scale. The cargo handling cranes provided on the piers are of the semi-gantry type, of 10 tons capacity. These cranes and the portable conveyors, tiering machines and loading machines are all electrically operated.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Unchanged Circumstances.

IRON and steel masters and manufacturers in the Midlands and Staffordshire have carried on this week much as last, industrial trading conditions having remained unchanged. Enterprise is still lacking, and the hoped-for improvement in demand has not as yet materialised. Industrialists generally are not pessimistic, but they have little cause for optimism. Work is irregular in practically every branch of Midland industry and order books generally are thin. Constructional engineers are still very short of work; consequently, there is no expansion of demand for heavy steel. Forgemen and foundrymen are poorly employed for the time of the year, and they are buying only for immediate needs. South Staffordshire heavy engineering industries show no improvement, nor does the automobile trade. Manufacturers report quiet conditions, and it is evident that supplies are being renewed only when stocks run out. It is only with difficulty that production is maintained at its present level, and fears of a general decline in productive activity in this district were this week voiced by those attending on 'Change. The weekly meeting was not largely attended, and there was a predominance of sellers. Transactions were few and of small volume.

Steel Prices.

Those consumers of heavy steel who had hoped for a reduction in steel prices were disappointed, manufacturers considering the time inopportune for any lowering of selling values. The decision of the Steel Manufacturers' Association to maintain the recent level of prices occasioned some surprise, but there were those who foretold the result of the review. It is understood that the view of steel masters was that in the difficult conditions in which mills are now working, a reduction in selling prices of heavy steel could only be justified by the expectation of a prompt rehabilitation of buying, and there seemed to be no prospect of such a response. Consequently, prices are for the present to remain as of late, namely, angles, £8 7s. 6d.; joists, £8 10s.; ship, bridge, and tank plates, £8 17s. 6d.—all subject to the scale of rebates which has applied hitherto. The steel market in the Midlands is in such a low condition at the moment that the maintenance of prices has caused little concern amongst users. Many of them are well supplied with material, and, in any case, the quantities they are likely to require in the immediate future are not large. Activity at the local steel works is mainly confined to small orders. Specifications are on such a meagre scale that rolling programmes cannot be economically arranged. Frequent roll changing at the mills is necessary. Makers of boiler plates are faring rather better, some of the Black Country consuming works having moderately good orders to be executed. Buyers pay from £9 12s. 6d. upwards for boiler plates. In the semi-finished department of the steel trade there is little of moment to record. Values are unchanged from a week ago, while the volume of business being done is on about the same scale as of late. Foreign competition is becoming even keener, merchants offering supplies of many classes of material at below the Cartel fixed prices. Particularly does that apply in the case of steel bars. Staffordshire re-rollers quote small bars from £8 to £8 15s., mild steel billets are £6 delivered, and Staffordshire hoops £10 per ton at makers' works.

Raw Iron.

Midland blast-furnaces are reported to be unable to dispose of their current output, and stocks are being steadily added to. Supply and demand have got out of adjustment, and some smelters are beginning seriously to think. There has been a steady but appreciable decline in consumption of foundry pig of late. The heavy engineering foundries and the light castings foundries have been operating less and less regularly, and smaller tonnages of iron have gone into the works. At the pipe foundries in Derbyshire, activity has been maintained to the decided advantage of a number of smelters, but it is not all the blast-furnaces which directly benefit, and in many cases makers have been unable to find outlets for the whole of their production. Those consumers who counted on this accumulation of stocks for a fall in pig iron prices have up to now been disappointed. There is not the slightest sign of weakness on the part of Midland furnacemen. They adhere firmly to the prices fixed by the Association and will not even listen to talk of "concessions." Users on their side continue to pursue the policy of hand-to-mouth buying adopted some months ago as a protest against the maintenance of selling prices at what they consider an unjustifiably high level. There appears to be an excess of furnace coke on the market just now, and supplies are to be had on very favourable terms. As low as 12s. 6d. per ton at ovens was named in Birmingham this week. Furnacemen are taking advantage of these offers, and at a later date they may be prepared to pass on some of the saving to pig iron consumers. At date, however, prices remain at:—Northamptonshire No. 3 foundry, £3 15s.; forge, £3 11s.; Derbyshire foundry, £3 18s. 6d.; forge, £3 14s. 6d. per ton delivered Black Country stations.

Finished Iron.

Makers of Staffordshire best grade iron bars maintain operations at recent levels despite the depression in other branches of the iron trade. Not only so, but they are able to sustain the price level at £12 10s. per ton, a figure which has ruled for many months past, without fear of loss of business resulting. For exacting engineering requirements, Staffordshire marked bars are recognised as almost indispensable; consequently, there is always a fairly consistent demand for this product. Iron strip for the tube works has also had a good run of business, and while producers could comfortably entertain additional orders, they are faring moderately well. Values are upheld at £11 2s. 6d. per ton. In the Crown bar department trade is decidedly bad, and prices are weak, varying from £10 to £10 7s. 6d. per ton. Makers of nut and bolt and fencing bars are even worse off. Continental competition shows no sign of slackening, and with a difference of over £3 per ton in local makers' quotations and those of sellers of Belgian material, the outlook is far from rosy. Staffordshire ironmasters engaged in the production of common bars are becoming despondent. They can see no prospect of a change for the better in their position as long as cheap continental material is permitted free access to this market.

Galvanised Sheets.

Inquiries for galvanised sheets have been a little better this week, and a few useful orders have been booked. Indeed, some fortunate mills are now able to see some three weeks ahead, and regular rolling is in progress. Galvanised corrugated sheets of 24 gauge are maintained at £11 17s. 6d. per ton, while sheets of other gauges are unchanged in price. Little interest is being taken in tin-plates in this district at date.

Steel Scrap.

There has been no further fall in steel scrap prices, but that is probably because there has been no buying during the week. Merchants report the market to be stagnant, all the consuming works being amply supplied for present and immediate future requirements. All classes of steel scrap appear to be similarly affected.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Unemployment in the North-West.

THE settled opinion in engineering circles here is that the limit of optimism is to look for any material improvement in the industrial situation so far as the engineering trades themselves are concerned whilst the cotton and allied industries remain in so critical a plight. New cotton mills in Lancashire seem now to be a thing of the past, and it is not difficult to visualise the effect on constructional engineering, boilermaking, textile machinery manufacture, and a good many sections of general engineering. In this part of the country it is impossible to get away from the fact that, as much as ever it was, cotton is still the life-blood of Lancashire. Unfortunately, the latest unemployment returns relating to Lancashire, Cheshire and Cumberland, and, mainly, of course, Lancashire, show no sign of increasing animation in the industrial pulse. The number of insured persons out of employment in the area is now well above the half-million mark, and it is estimated that in the cotton and closely allied industries the percentage of unemployment among operatives is not far off 50, with the general figure in the neighbourhood of 28 per cent. It is scarcely likely that until there is a turn in the tide any real improvement will be witnessed in engineering.

Workshop "Safety First."

Manchester engineers are well represented on the Manchester Industrial Safety First Committee, and the effectiveness of the movement is reflected in the fact that the list of what are officially described as "lost-time accidents" is steadily dwindling. In no small degree this has been made possible by the application of common-sense methods, which consist primarily in a careful diagnosis of the causes of workshop accidents and the search for means of preventing their repetition. More than forty industrial concerns were represented at the fifth meeting of the Committee, which took place within the last few days at the works of Mather and Platt, Ltd., engineers, Newton Heath, Manchester, with Mr. L. E. Mather in the chair. A tour of inspection of the works was made after the Committee had completed its official business.

Profits Halved.

Although the financial results of the past year's trading operations are less depressing than in the case of

most other concerns in the same branch of business that have recently issued their balance sheets, nevertheless the net profits of Platt Bros. and Co., Ltd., textile machinery manufacturers, of Oldham, for the twelve months to the end of March were less than half what they were in the previous financial year. For 1926–27 the profit was £257,000, but there was a decline in the succeeding year to £73,000, a recovery in 1928–29 to £116,000, and a relapse in the period under review to £54,000. After providing for debenture interest and preference dividend, the sum of £4543 is carried forward to the next accounts, compared with £58,412 a year ago. The sum of £300,000 is being taken from the reserve funds as special provision against doubtful debts, this course being deemed advisable by the directors in view of the continued uncertainty in the cotton trade. This appropriation reduces the reserves to £700,000.

More Motor Omnibuses.

The Manchester Corporation Transport Committee, at a meeting on Tuesday of this week, decided to accept the tender of Crossley Motors, Ltd., for the supply of thirty double-deck motor omnibuses.

Non-ferrous Metals.

Values of non-ferrous metals during the past week, although still generally unstable, have finished up higher on balance, spelter being the only exception. In spite of the fact that tin is dearer to the extent of from £4 to £5 a ton compared with a week ago, the metal has passed through a troublous period. Selling waves, with buying movements sandwiched in between, have succeeded one another, and, although the recovery in prices at the time of writing is all to the good, a stable market seems still to be some distance ahead. Copper values, largely in sympathy with tin and owing, in part also, to American influences rather than to any actual improvement in the trade demand, have moved upward to the extent of about £1 15s. for all positions. In this case, however, the metal has a fair way to go before the loss of the previous week is made good. A moderate buying movement has been in evidence in the lead section and a rise of 5s. has brought quotations back to where they were for about a fortnight prior to last week's decline. Spelter has attracted relatively little attention, and for the third week in succession prices have steadily lost ground.

Iron and Steel.

There has been little in the way of development on the iron and steel market during the week to give cause for satisfaction, for quietness has been almost the general rule. Demand for foundry iron has been restricted and new orders have been few and for relatively small quantities, buyers being still content to cover their needs on what is little more than a week-to-week basis. Unless there is a marked change in conditions, the probability is that even the present reduced consumption will undergo a seasonal contraction. Prices, however, are steady at 77s. per ton, delivered equal to Manchester, for Staffordshire and Derbyshire No. 3, 72s. for forge, about 94s. for Scottish makes, and from 89s. to 90s. per ton for West Coast hematite. Bar iron is a slow trade at £10 5s. per ton for Lancashire Crown quality, and about £8 15s. for seconds material. In the aggregate there has, perhaps, been a slightly better movement of constructional steel, almost wholly against existing contracts, owing to an improvement in the position of one or two individual firms, but, except that there is still a moderate demand for steel for the locomotive branch, interest in the market is very poor. Rollers of boiler plates continue to quote from about £9 17s. 6d. to £10 per ton for acid and basic qualities, with general plates at £8 17s. 6d., 3in. and upward bars at £9 7s. 6d., angles at £8 7s. 6d., joists at £8 10s., and small re-rolled bars at from £7 17s. 6d. to £8 per ton.

The Late Mr. Wallace Bridge.

The death of Mr. Wallace Bridge is announced as having taken place at a nursing home at Taunton on the 24th inst. at the age of 47. Mr. Bridge was a director of the Castleton engineering firm of David Bridge and Co., Ltd., and the youngest brother of the late Mr. Robert Bridge, whose activities in connection with rubber machinery were so well known. The whole of the business life of Mr. Wallace Bridge was spent with his firm, where he was in charge of the foundry. He was a prominent Mason and occupied the position of Past Provincial Grand Treasurer of East Lancashire.

BARROW-IN-FURNESS.

Hematite.

There is still no improvement in the hematite pig iron market and buyers are just taking iron to satisfy present requirements, which, in many cases, are light. Makers are still engaged to the same extent as regards output, but that is accounted for by the fact that there are several contracts to complete. A bad feature at present is the attitude of the buyer, who is not inclined to renew contracts and place orders for forward delivery over many months ahead. It is possible that many customers are not requiring such heavy deliveries. The market is also affected by keen competition from the East Coast. If, when present contracts are completed, there are not better signs, there will be an immediate curtailment of output, but makers hesitate to damp down till the last moment, for that operation is costly. Stocks are growing in some works and that is not a very encouraging sign. There have been further shipments to the Continent and it is hoped this business in special qualities will continue despite keener German competition. Iron ore remains about the same, but the outlook is not so bright. The steel market is dull and none of the works is well placed as regards orders. Shipping of late has been quiet. Employment at engineering and shipbuilding works is not as good as it was this time last year, there being about 2000 fewer employed.

SHEFFIELD.

(From our own Correspondent.)

Position Still Unsatisfactory.

THE resources of Sheffield, for the manufacture of steel and steel goods, are at present being called upon to a less extent, in relation to their capacity, than has been the case for many years. Although a comparison with the pre-war period shows that progress has been made, the productive powers of the city have been so greatly increased that the present demand does not suffice to employ them to anything like their full extent. It is, in fact, stated in more than one well-informed quarter that the present spell of depression is the worst that has been experienced since the slump of 1920, and it appears to be even more general than at that period. It is only a minority of firms that are in a prosperous condition, and even they are beginning to feel difficulties. There are probably several that are just able to pay their way, but others are finding it necessary to carry out drastic economies on both productive and administrative sides. As a result of these measures, the roll of unemployed is being constantly increased. Nor are there any signs of improvement. Various basic industries in this country, which normally make large calls on Sheffield, are depressed, and trade with the best foreign markets is on much less than the customary scale.

Open-hearth Steel and Pig Iron.

All the departments of the United Steel Companies at Templeborough and Rotherham are closed this week for stocktaking and holidays. The company reports that the demand for open-hearth steel is restricted, and that the inquiries coming to hand are poor. The majority of the open-hearth furnaces in Sheffield are still out of commission. Holidays and stocktaking are interfering with trade in Lincolnshire, but the general position is weak. In the case of some firms, however, it is thought that there are signs of improvement during next month. Stewarts and Lloyds, of Glasgow, have decided to close their North Lincolnshire Ironworks, at Scunthorpe, on account of bad trade. Two blast-furnaces have been operating at the works for the past twelve months, but it is stated that the present stock of pig iron amounts to 15,000 tons, and that under present trading conditions it is impossible for the works to carry on. All the workmen, numbering over 300, have received fourteen days' notice to terminate their employment.

Some Departments.

The call for shipbuilding steel is very poor, as it has been for a long period. There is a substantial trade in stainless steel, also in cold wrought steel and strip, but it is not up to the levels of last year. The automobile trade of the country is feeling the effect of the present unsatisfactory position, and, although its demands upon Sheffield still provide a valuable amount of work, the turnover shows a considerable fall. There is a fair demand for engineers' and mechanics' small tools and hacksaws, but the file trade is badly in need of orders.

New Government Orders.

The names of a number of well-known firms in Sheffield and district appear, as usual, in the latest list of orders placed by various Government Departments. The Admiralty has ordered carbon steel drills and drill sockets from the International Twist Drill Company, Ltd., Joseph Evans and Sons, Ltd., and the Stalker Drill Works, Ltd.; high-speed drills from Thos. Firth and Sons, Ltd., Sanderson Brothers and Newbould, Ltd., and Moses Eadon and Sons, Ltd.; and propeller shafts from Thos. Firth and Sons, Ltd. The War Office has placed orders for files and rasps with G. Barnsley and Sons, and Sanderson Brothers and Newbould, Ltd.; and for steel plates with the Park Gate Iron and Steel Company, Ltd. To the Crown Agents for the Colonies, bolts and nuts are to be supplied by G. Cooper and Sons., Ltd.; pipes by the Stanton Ironworks Company, Ltd., and the Staveley Coal and Iron Company, Ltd.; tires by J. Baker and Bessemer, Ltd., and Brown Bayley's Steel Works, Ltd.; and superheater elements by the Superheater Company, Ltd.

Company News.

It is a pleasure to be able to report that, even in these times, there are companies which can record an increase in profits. One of these is Edgar Allen and Co., Ltd., of Sheffield, who, in spite of a difficult year, made a profit of £23,491, as compared with £16,783 in the previous period. The dividend is again 2½ per cent., less tax. In the case of the Stanton Ironworks Company, Ltd., near Nottingham, the profit comes out at £240,531, an increase of about £44,000, and the dividend is maintained at 10 per cent., tax free. At the annual meeting of Marshall, Sons and Co., Ltd., of Gainsborough—who, unfortunately, had to report a drop in profits—Major Marshall stressed the development of the firm's oil engine trade, mentioning that they had now produced a crude oil tractor which they considered to be most effective for the purposes of ploughing and threshing. He also stated that they had taken steps to ensure a continuance of the manufactures of Clayton and Shuttleworth, of Lincoln, whose goodwill and stock they had acquired. They had met with some success and they looked forward to an even greater turnover.

Orders for American Factory.

The Norton Grinding Company, of Worcester, Mass., which is erecting a new factory at Welwyn Garden City, has placed orders for eight presses for the necessary machinery with Davy Brothers, Ltd., engineers, of Sheffield. The firm also has factories in Germany, France, and Ontario. Its branch at Welwyn is to cost over £200,000, and is being built entirely by local labour and with local materials. An official states that the company is transferring the production of emery wheels and abrasive wheels to this country, mainly for economical reasons, so that the product can reach the consumer at lower prices. There will be direct advantages arising from production in England. Work will be found for 200 hands, supervised at first by technical experts from America.

Colliery Matters.

There is a prospect of development, though not immediately, of the Ramcroft Colliery, Heath, Derbyshire, which has been closed since the early part of last year. It has been bought by the Hardwick Colliery Company, which intends to sink to the lower seams. In the present state of the industry, however, the question of when the work shall be begun is a matter for serious consideration. When it does start, some twelve or eighteen months will elapse before coal can be turned out in any large quantity. Turning from Derbyshire to Yorkshire, there is a different story to tell with regard to the Robin Hood Colliery, between Leeds and Wakefield, the owners of which, J. and J. Charlesworth, Ltd., have definitely decided to close it, because of the depressed state of the industry. The decision affects 800 men and boys.

Cutlery and Plate.

The cutlery and plate trades show no signs of improvement, but rather the contrary. The export trade is suffering greatly in some of its best markets, owing to the boycott of British goods in India and the prohibitive tariff imposed by Australia. The home trade, which has been very quiet for a considerable time, is now falling off further in view of the forthcoming expiration of the safeguarding duty on cutlery. It is feared that the early part of next year will see a deluge of cheap continental cutlery in this country, and in the meantime buyers are refraining from building up stocks and are making only such purchases as they need for immediate disposal. This state of things affects scissors, pocket knives, and safety razor blades, sections which have hitherto been among the most active. The great falling off in the export cutlery trade is shown by the returns for May. The value of the exports in that month was only £66,803, as compared with £83,334 in April and £106,776 in May of last year. The loss was spread over all sections of the industry. Australia's purchases in May only reached £17,000, which was a record low total. The New Zealand figure was also poor, as was that of Argentina, trade with which country has been the reverse of satisfactory for a considerable time. While the export of safety razor blades is still large, it appears to have ceased to be progressive. The imports of cutlery for the first five months of the year are not equal to last year's, the value being £206,047, against £326,225, but the figure for May itself, at £39,000, showed an advance.

NORTH OF ENGLAND.

(From our own Correspondent.)

Shipbuilding Orders in Prospect.

THERE is every prospect of orders for two 20,000-ton whaling tankers, similar to that recently launched on the Tees, being placed with the Furness Shipbuilding Company, of Haverton Hill. Negotiations have not yet been completed, but it is confidently expected that the deal will prove successful. The vessels will be of the pattern of the whale tanker, "Sir James Clark Ross," a vessel of 19,500 tons, launched in April. These new orders, however, will be for different owners. The "Sir James Clark Ross" had the distinction of being the biggest vessel launched on the Tees. She has a length of 550ft., breadth of 74ft. and depth of 48ft. She has special fixtures, such as her own whaling factory and special methods of tipping residue whale products into the sea. She also has accommodation for an aeroplane. This vessel required 8000 tons of Cleveland steel, and the benefit in this direction which will accrue through the new orders can be imagined. It is expected that work for a year or thereabouts will be provided if the orders are secured.

New Coke Plant.

Work has been started at Roddymoor, one of Pease and Partners' group of collieries in the Crook district, upon the construction of a new low ash plant to deal with the coke produced at the Bankfoot coke ovens. The plant will include the erection of a conveyor, elevators, coal-crushing and washing machinery. The significance of the new plant is that the coke will be produced with a much lower percentage of ash than is at present possible. Experiments have been carried out over a long period and have been such as to evolve a new process by which coke can be produced with a percentage of ash less than 4½. This, it is anticipated, will have important advantages for smelting purposes, and the use of coke for smelting will result in a considerable improvement in the quality of iron and steel in connection with the manufacture of which it will be used. The new plant is being erected near the existing coal washery, and when completed will be a large structure. Also, it will be the only plant of its kind in the North of England.

Cleveland Iron Trade.

A cheerless tone pervades the Cleveland pig iron market, and the outlook is most perturbing. Deliveries are shrinking, and with contracts on hand approaching completion and consumers showing disinclination to negotiate for further supplies, present tonnage output cannot be maintained. Disappointment is expressed that there has been no further reduction in Cleveland iron prices, but makers claim that costs of production preclude any concessions. No. 1 Cleveland foundry iron is 70s.; No. 3 G.M.B., 67s. 7d.; No. 4 foundry, 66s. 6d., and No. 4 forge, 66s.

Hematite Pig Iron.

There is next to nothing being done in the East Coast hematite pig trade. Customers are very backward and are not at all disposed to discuss forward business. Under such circumstances transactions are almost confined to the purchase of small lots of material to meet early needs. Values show further fall, and terms of sale vary

considerably, but makers now offer iron at the equivalent of ordinary qualities at 71s. 6d. No. 1 quality is at a premium of 6d. per ton.

Ironmaking Materials.

Transactions in imported ore are almost unheard of. On a Bilbao freight of 5s. 6d. the nominal price of best Rubio ore is 20s. c.i.f. Tees. Blast-furnace coke is plentiful and slow of sale. Consumers in this district claim that they can satisfy their requirements on the basis of Durham good average qualities at 16s. 6d. delivered at the works, but producers decline to enter into extensive forward contracts on such terms.

Manufactured Iron and Steel.

There appears to be a slightly better demand for sheets, but the plate mills are becoming very slack owing to the declining activity at the shipyards. Home makers of semi-manufactured steel are getting a fair share of orders, but foreign producers are cutting keenly in order to keep their plant employed. All prices are unchanged.

The Coal Trade.

Business in the North of England coal trade has been in a very dull condition throughout the month, and, at the close, prospects give no encouragement that the worst period has been passed. There is considerable idle time throughout all the northern areas, and no renewal of activity is discernible. The result of the tendering for several orders for gas and steam coal to Scandinavia will probably be known by the end of the week, but fresh inquiries are coming in very slowly. There are not sufficient orders in prospect to ensure regular working. It is thought that July will be no better. After that the shortening days will bring a better home demand, and export trade will no doubt expand, but there are heavy stocks to work off before trade will move freely. With ample supplies of all descriptions of steam coal available for the ensuing three or four weeks, combined with a very limited new demand, prices are quoted at late minimum values. Best qualities are 13s. 6d. and smalls are offered freely at 10s. 6d. Durham best steams are moving slowly and in good supply for first qualities at 15s. 6d. and for small at 12s. 6d. There is not much variation in the Durham coal trade, but here and there a steadier tone is developing for coking unscreened qualities. For early shipment buyers find that they can readily cover requirements at a 13s. to 13s. 3d. basis according to grade, but for more forward dates 13s. 6d. is the minimum quotation. Superior classes of Durham gas coals are plentiful at 15s. 6d. to 15s. 9d., but new business is very scarce. The bunker coal trade is very disappointing, as neither for vessels' use at shipping ports nor from the coaling stations is there any sign of an active demand. Unscreened are on offer at 14s. and secondary descriptions at 13s. to 13s. 6d. Gas coke is scarce and quoted firmly at 21s. 6d. Patent coke remains dull and easy for early delivery, good brands at 17s., but for the last quarter of the year 17s. 6d. to 18s. is firmly indicated. Beehive and superior foundry coke is quoted unchanged at 24s. to 28s.

SCOTLAND.

(From our own Correspondent.)

Steel.

THE market at present holds little of fresh interest, general conditions showing little or no change. As a rule, producers find some difficulty in maintaining even a restricted degree of employment, and outputs continue on the low scale pertaining for some months past. Export demands are not encouraging, and though there may be prospects of a slight turn for the better, in view of recent shipbuilding orders, the outlook will be considerably improved if rumours of other large shipbuilding contracts materialise. Meanwhile, it is thought that some definite improvement should be noticeable about the end of August next. The amount of business being done for export is computed to be only about 50 per cent. of the normal turnover, so far as India is concerned, while Australia has almost disappeared out of the market since the revision of the tariff duties there some months ago. Galvanised sheets suffer from the drop in Indian demands, and makers have difficulty in keeping their machinery running. A comparatively good turnover in black sheets has helped in some degree to restore the balance. With regard to the tube trade, it has to be noted that orders for small diameter tubes are still on a small scale, and though large varieties are well specified, the industry on the whole is worse off than it has been for some time past.

Iron.

Producers engaged on bar iron and re-rolled steel bars continue to experience a very lean time, and can find no encouragement in the state of the inquiry. Prices are nominally unchanged, but, doubtlessly, a cheaper figure might be named for a good prompt order, apart from the home price of £10 5s. per ton for Crown iron bars, which is fixed. The export quotation is in the region of £9 15s. per ton, and the home and export price of re-rolled steel bars is nominally £7 12s. 6d. per ton.

Pig Iron.

The market for pig iron has shown little signs of life for a long time past, and, in the hope of inducing some improvement, prices have been reduced by 1s. 6d. per ton, making current quotations as follows :—Hematite, 79s. 6d., delivered steel works ; No. 1 foundry, 79s.; No. 3 foundry, 76s. 6d. per ton, f.o.t. at furnaces. The number of furnaces in blast in Scotland is twenty-five, ten making hematite and fifteen ordinary iron.

Scrap.

The demand for scrap has dwindled, and prices show further weakness, with cast iron machinery at 65s.; heavy steel, 52s. 6d.; and heavy basic about 55s. per ton.

Coal.

If anything, the depression in the Scottish coal market has become more acute during the past week. There is no sign of improvement in shipping demands, and with the home turnover remaining far below normal, the collieries in all districts suffer a considerable amount of idle time. All descriptions of round coal show further weakness, and nuts alone maintain a semblance of strength, owing chiefly to restricted supplies. Aggregate shipments amounted to 232,258 tons, against 236,562 tons in the preceding week, and 250,829 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

To all outward appearances the coal trade has not undergone any material change during the past week, and there can be no doubt that many collieries are continuing to work very irregularly, which is a very costly procedure. Unfortunately, the business is not on the market for prompt loading, and when a new order does come along there is intense competition for it. Shipments last week marked no improvement, but were again round about the half-million tons mark. Tonnage was insufficient to absorb anything like the production of which this district is capable. At the end of the week ships in dock had been so expeditiously dealt with that there were as many as forty-six idle tipping appliances at the various docks. As the result of arrivals over the week-end, the position was not a great deal better, as the number of appliances not in use on Monday was thirty-nine, and there were only five steamers waiting to get into berth. One satisfactory feature, however, is the fact that last week there was an improvement in the amount of chartering. The total amount of tonnage reported as having been taken up was close on 300,000 tons, whereas the previous week the quantity was only a shade over 150,000 tons. Even 300,000 tons is a long way short of what is required to create activity at the loading ports of this district, but the fact that this amount was chartered gives one the impression that during the next week or so the conditions in the coal trade will be maintained about the present level. It is not, however, a healthy level. There is no strength in the position generally, and prices cannot rise above the minimum figures. It is not surprising therefore to hear that the Executive Committee of the South Wales Marketing Association recognises the necessity of adjusting production more to the demand, and has agreed that for the September quarter allocations shall be on a lower basis than for the June quarter.

Business Ahead.

Fresh inquiries for coals for early delivery have been so quiet, and give so little indication of immediately improving, that it is not surprising to find that interest during the past week or so has been directed to the report of fairly considerable business being done for delivery ahead. It is stated that the Paris–Orleans Railway is in the market for supplies over 1931, but apart from that there is authority for stating that contracts have been entered into for over 400,000 tons of sized coals for delivery over 1931 and 1932. The actual prices at which this business has been taken are not disclosed, but it is a tribute to the enterprise of the firms concerned that they should take the risk of c.i.f. orders so far ahead. Who can possibly tell what the freight rate will be over the next two years for Buenos Aires and Rosario and Lisbon ? Yet this risk has been taken and the business has been secured in spite of the keenness of foreign competitors. Of the total quantity of coals sold, viz., over 400,000 tons, which is quite a respectable percentage of the total production of this class of coals, in this district per annum, 50,000 tons is for delivery at Lisbon over 1931, and the rest is for delivery at Buenos Aires and Rosario over 1931 and 1932. The coals are for electricity works.

Coal Shipment Hours.

Reference was made recently to the action of the coal trimmers and tippers in this district in taking a ballot and demanding that the hours of work at the docks should be altered so that there should be no night work, and that there should be a reversion to the system of two-day shifts. All the employing interests strongly opposed such a proposal, and a reasoned statement was issued by them pointing out the damage that would follow if it were carried into effect. It seems that this has not been without its effect ; at any rate, there appears to be a more reasonable spirit prevalent among the leaders, if not among the men. Last week there was a conference of executive representatives of the unions to which the workmen belong, the upshot of which was a decision to approach the representatives of the employers and make another effort to secure a mutual arrangement. It is understood that it has been arranged for a meeting between the parties to take place at Cardiff on Monday next.

South Wales Miners.

The annual conference of the South Wales Miners' Federation takes place at Cardiff at the end of this week. The agenda presents the usual interesting features, resolutions being advanced from various areas demanding all sorts of concessions from the owners. In the case of the new wages agreement, a proposal from one lodge submits that it shall contain a clause making membership of the Federation a condition of employment. Other proposals concern various alterations regarding payment of the workmen. Another motion calls for nationalisation and not rationalisation, enforced retirement with adequate pensions of all miners at sixty and over, and reduction of hours of employment with a guaranteed weekly wage. One lodge calls for the withdrawal of all conveyors from the coal face, and another proposal is that the Conference should urge the Government to establish at convenient points in the coalfield national coal-distillation plants for the production of crude oil. There are various resolutions regarding hours of work and a number respecting holidays, one of them being that the next agreement should provide for two weeks holidays with pay.

Works Closing.

It is reported that the Briton Ferry blast-furnaces, which were taken over three years ago by Baldwins, Ltd., are to be closed down indefinitely. About 120 men will be thrown out of employment. Fears are entertained that the Cromfelin Steel and Tin-plate Works will also close. They belong to Richard Thomas and Co., Ltd. The Swansea Corporation is doing its best to avert a stoppage, and has appointed a committee to interview the representatives of the company.

Current Business.

There is no development in the state of the market for prompt loading. Coals of practically all descriptions are freely obtainable for early shipment. Large qualities are especially excessive, and the accumulation of stocks is a menace to the regular working of many collieries. Smalls are also obtainable without any difficulty, but some of the sized descriptions are not so plentiful and have a fairly steady market. Coke meets with a moderate inquiry, but patent fuel is quiet. Pitwood displays very little change. The supplies coming forward are limited, but the demand from the collieries for this commodity is also restricted.

LAUNCHES AND TRIAL TRIPS.

CIUDAD DE CORRIENTES ; motor ship ; built by A. and J. Inglis, Ltd., to the order of the Argentine Navigation Company, Ltd.; dimensions, 320ft. by 58ft. 6in. by 27ft. Engines, three six-cylinder, single-acting, airless injection Diesel ; constructed by Harland and Wolff, Ltd.; launch, June 10th.

JACQUES SCHIAFFINO, steamship ; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Société Algerienne de Navigation pour L'Afrique du Nord ; dimensions, 274ft. 9in. by 38ft. 6in. by 21ft. 9in.; to carry 2500 tons. Engines, triple-expansion ; constructed by the builders ; launch, June 10th.

MORGENEN, oil tank motor ship ; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of A/S Tanktransport ; dimensions, 456ft. by 58ft. 9in.; to carry 10,500 tons. Engine, six-cylinder Neptune Atlas Polar Diesel ; constructed by the builders ; launch, June 10th.

CONTRACTOR, steamship ; built by Cammell Laird and Co., Ltd., to the order of the Charente Steamship Company, Ltd.; dimensions, 416ft. 3in. by 54ft. 3¼in. by 32ft. 7in. Engines, triple-expansion, 27in., 46in. and 77in. diameter by 54in. stroke, pressure 210 lb. per square inch ; constructed by the builders ; launch, June 11th.

HOLMSIDE, steamship ; built by Cowpen Dry Docks and Shipbuilding Company, Ltd., to the order of Burnott Steamship Company, Ltd.; dimensions, 350ft. by 48ft. by 25¼ft.; to carry 5600 tons. Engines to be constructed by North-Eastern Marine Engineering Company, Ltd.; launch, June 11th.

FOYLEBANK, motor ship ; built by Harland and Wolff, Ltd., to the order of Andrew Weir and Co.; dimensions, 425ft. by 55ft. by 38ft. 7in.; gross tonnage, 5680. Engines, two Harland-B. and W. eight-cylinder airless injection ; constructed by the builders ; launch, June 12th.

LOSSIEBANK, motor ship ; built by Workman, Clark (1928), Ltd., to the order of Andrew Weir and Co.; dimensions, 440ft. by 57ft. by 38ft. 7in. Engines, twin five-cylinder Sulzer type ; constructed by the builders ; trial trip, June 12th.

SAINT EMILION, steamship ; built by David and William Henderson and Co., Ltd., to the order of Worms and Co.; dimensions, 236ft. by 34ft. by 16ft. 9in.; gross tonnage, 1200. Engines, triple-expansion, 18in., 30in. and 50in. diameter by 36in. stroke, pressure 200 lb. per square inch ; constructed by the builders ; launch, May 12th.

INNISFALLEN, motor ship ; built by Harland and Wolff, Ltd., to the order of the City of Cork Steam Packet Company, Ltd ; dimensions, 320ft. by 45¼ft. by 19ft ; gross tonnage, 3250. Engines, two ten-cylinder, Harland-B. & W. airless injection, trunk-type Diesel ; constructed by the builders ; trial trip, June 14th.

HAVSTEN, motor tank ship ; built by Barclay, Curle and Co., Ltd., to the order of Rafen and Loennechen ; dimensions, 420ft. by 58ft. 6in. by 31ft. 3in.; to carry oil in bulk. Engine, four-cylinder, two-cycle Barclay, Curle-Doxford opposed piston, airless injection, 3000 B.H.P.; constructed by the builders ; launch, June 17th.

PLATANO, turbo-electric steam ship ; built by Cammell, Laird and Co., to the order of Elders and Fyffes, Ltd.; dimensions, 415ft. by 56ft. by 34ft.; displacement, 10,500 tons. Engine, 5500 kW turbo-alternator, equipment constructed by the British Thomson-Houston Company, Ltd.; trial trip completed June 20th.

FJORDHEIM, steamship ; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Nils Rogenaes ; dimensions, 384ft. by 51¼ft. by 26ft.; to carry 6600 tons deadweight. Engines, triple-expansion, Bauer-Wach system ; constructed by the North-Eastern Marine Engineering Company, Ltd.; trial trip, June 24th.

CROMPTON-PARKINSON, LTD., ANNUAL SPORTS MEETING.—The annual sports meeting of Crompton-Parkinson, Ltd., was held on Saturday last on their private ground at Chelmsford, and everyone was delighted that Colonel R. E. Crompton, despite his great age, was again able to be present. The programme comprised some thirty-two events, including six championships, and the event of the day was the inter-section competition for the new Hardie Cup presented by Lieut.-Col. C. Hardie, D.S.O., which was won by the apprentices section. The prizes were presented by Mrs. C. Hardie and a vote of thanks to her was proposed by Colonel Crompton.

THE ROYAL METAL TRADES PENSION AND BENEVOLENT SOCIETY.—The Board of Management of the Royal Metal Trades Pension and Benevolent Society has the pleasure to announce that Sir Gerald Chadwyck-Healey, Bt., C.B.E., Chairman of Morgan Brothers (Publishers), Ltd., Proprietors of the *Ironmonger*, THE ENGINEER, &c., and Chairman of A. G. Mumford, Ltd., Engineers, Colchester, will preside at the eighty-second Anniversary Festival Dinner of the Society, which will be held, by the kind permission of the Worshipful Company of Ironmongers, at Ironmongers' Hall, Shaftesbury-place, Aldersgate-street, London, E.C., on Tuesday, November 25th, 1930. The attendance will be limited to gentlemen. The price of the dinner tickets, exclusive of wine, will be 15s. each.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/6 to 21/-
(1) Spanish	20/6 to 22/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	20/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 19 6	—
No. 1 Foundry	3 19 0	—
No. 3 Foundry	3 16 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 11 6	3 11 6
No. 1	3 12 0	3 12 0
Cleveland—		
No. 1	3 10 0	3 10 0
Silicous Iron	3 10 0	3 10 0
No. 3 G.M.B.	3 7 6	3 7 6
No. 4 Foundry	3 6 6	3 6 6
No. 4 Forge	3 6 0	3 6 0
Mottled	3 5 6	3 5 6
White	3 5 6	3 5 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 15 6	—
" " Foundry	3 19 6	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	4 5 6 (*a*)	—
	4 8 6 (*b*)	—
	4 12 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 7 6	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
" " (Land)	10 0 0	10 0 0
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	12 15 0	12 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
" " (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
" (Small Round)	7 17 6 to 8 0 0	—
Hoops (Baling)	10 0 0	9 15 0
" (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
" (Lancs. Boiler)	9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 10 0	—
Hoops	9 15 0 to 10 0 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 15 0	—
Billets and Sheet Bars	6 0 0 to 6 12 6	—
Galv. Sheets, f.o.b. L'pool	11 17 6	—
Sheets (30 W.G.)	16 7 6	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/- to 18/3
Block Tin (cash)	136 12 6
" (three months)	138 10 0
Copper (cash)	48 17 6
" (three months)	48 17 6
Spanish Lead (cash)	18 0 0
" " (three months)	18 0 0
Spelter (cash)	16 5 0
" (three months)	16 15 0
MANCHESTER—	
Copper, Best Selected Ingots	56 0 0
" Electrolytic	56 10 0
" Strong Sheets	83 0 0
" Tubes (Basis Price), lb.	0 1 0
Brass Tubes (Basis Price), lb.	0 0 11
" Condenser, lb.	0 1 1
Lead, English	19 12 6
" Foreign	18 0 0
Spelter	16 15 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/1 per lb.	
Ferro Tungsten	2/10 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 12 6	7/-
" " 6 p.c. to 8 p.c.	£22 10 0	7/-
" " 8 p.c. to 10 p.c.	£22 0 0	7/-
" " Specially refined		
" " Max. 2 p.c. carbon	£33 10 0	10/-
" " " 1 p.c. carbon	£38 0 0	13/6
" " " 0·70 p.c. carbon	£39 0 0	15/-
" " " carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
" " "	£11 0 0 for export	
" Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/- per unit	
" " 75 p.c.	£19 0 0 scale 7/- per unit	
" Vanadium	12/9 per lb.	
" Molybdenum	4/2 per lb.	
" Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	12/6
" " Ell	13/3
" " Splint	14/- to 15/-
" " Trebles	12/6
" " Doubles	12/-
" " Singles	11/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
" " Jewel	16/-
" " Trebles	12/6
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	10/3 to 12/9
Screened Navigation	16/6 to 17/6
Trebles	13/- to 14/-
Doubles	11/6 to 12/-
Singles	11/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/6
Secondary Steam	11/-
Trebles	13/-
Doubles	11/6
Singles	11/3

ENGLAND.

	Inland.
(8) N.W. COAST—	
Steams	20/6 to 22/-
Household	32/- to 51/-
Coke	21/- to 21/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/-
Steam Smalls	10/- to 10/6
Unscreened	13/-
Household	25/- to 37/-
DURHAM—	
Best Gas	15/6
Second	13/3 to 13/6
Household	25/- to 37/-
Foundry Coke	24/- to 28/-
SHEFFIELD—	
Best Hand-picked Branch	25/- to 26/6 —
Derbyshire Best Bright House	20/- to 22/- —
Best House Coal	19/- to 20/- —
Screened House Coal	17/- to 19/- —
" " Nuts	15/- to 17/- —
Yorkshire Hards	14/- to 15/6 —
Derbyshire Hards	14/- to 15/6 —
Rough Slacks	8/6 to 9/- —
Nutty Slacks	7/- to 8/- —
Smalls	3/- to 5/- —
Blast-furnace Coke (Inland)	15/6 on rail at ovens
Furnace and Foundry Coke (Export), f.o.b.	17/- to 18/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/-
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 18/9
Ordinary Dry Large	17/6 to 18/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/- to 18/3
Best Eastern Valley Large	17/9 to 18/-
Ordinary Eastern Valley Large	17/6 to 17/
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	12/6 to 13/-
Washed Nuts	17/- to 19/-
No. 3 Rhondda Large	20/6 to 21/-
" " Smalls	15/6 to 16/-
No. 2 " Large	17/- to 17/3
" " Through	16/- to 16/6
" " Smalls	14/- to 14/3
Foundry Coke (Export)	30/- to 37/-
Furnace Coke (Export)	25/- to 27/6
Patent Fuel	22/- to 22/6
Pitwood (ex ship)	26/3 to 26/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/- to 37/6
Seconds	27/6 to 31/6
Red Vein	23/6 to 27/6
Machine-made Cobbles	41/6 to 45/-
Nuts	40/- to 46/-
Beans	24/6 to 27/6
Peas	20/- to 21/-
Breaker Duff	10/- to 10/6
Rubbly Culm	11/3 to 12/3
Steam Coals:	
Large	19/6 to 20/6
Seconds	18/- to 19/6
Smalls	12/6 to 13/-
Cargo Through	15/6 to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/- if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Steel Prices.

IT does not seem likely that the fall in German steel prices following upon a reduction of wages will have the effect of cutting British prices, since they can only apply to home business, the prices for export being fixed on a minimum basis by the international comptoirs. It is true that there appears to be some difficulty in maintaining that minimum pending the operation of the permanent comptoir, which will be able to exercise a more rigid control than the existing temporary bodies. During the week it is affirmed that some business in merchant bars has been transacted in Brussels at 5s. below the official minimum of £5 7s. 6d. If the German reduction should be followed by the other countries belonging to the Cartel, there is always the possibility of the minimum for export being further reduced. The effect of the lower steel prices in Germany will be to bring down the cost of manufactured goods there, and the competition for foreign trade in engineering products will therefore become more severe.

Refuse Incineration.

In view of the objections that are being raised by the Paris suburban authorities to the laying down of refuse incineration plants, a paper was read recently by Monsieur Schwertzler before the Société des Ingénieurs Civils de France upon the results obtained by the Société pour le Traitement Industriel des Résidus Urbains, which deals with the whole of the Paris refuse. The point insisted upon was the value of the system as a means of producing energy at low cost. The average heat value of the Paris refuse is 1860 calories per kilogramme, the figures being 2240 in winter and 1480 in summer. In summer, on account of the quantity of vegetable matter it contains, the refuse is first dried by the gases as they leave the furnace at a temperature of 220 deg. Cent. About 85 per cent. of the heat of combustion is used for steam raising. The plants produce annually 70 million kilowatt-hours, of which 10 millions are absorbed by the company, the remainder being available for distribution. After passing over magnetic separators, the refuse is carried through rotary sieves which leave a fine product suitable for manure. The quantity of slag from the Paris plants is considerable, amounting in winter to about 1000 tons a day, and it is used to make bricks.

Civil Aviation.

With the 400 million francs it is proposed to devote to civil aviation under the scheme of national equipment, in addition to the sums provided by the annual estimates, the Minister of Air will be able to carry out some of the more urgent projects for creating international air services. The technical side will benefit from the reforms in the military service, in which the design and construction of machines are being organised with a view to the creation of fewer recognised types of machines and to a concentration of effort. At the same time, the construction of commercial machines will be developed separately, and while the Air Ministry is carrying out tests with British machines, it has secured one of the big German air liners which arrived at Villacoublay recently. The experiments aim at selecting the best types for the services now in preparation, notably from France to Syria, with an extension eventually to Indo-China, from Brussels to the Belgian Congo, and later on to Madagascar, and from France to South America, where the greater part of the sea journey is at present accomplished by small fast boats. Having secured concessions from several of the South American Governments, the French are developing the services there, and machines are being flown experimentally to Bolivia and the Antilles. The idea of organising lines in France to connect up the different big towns has been abandoned. The service which was run last year between Geneva and Bordeaux proved a failure. Nevertheless, it is intended to lay out landing grounds in different parts of the country, the first being a large air port at Lyons, and provision will be made for luminous signalling at night.

Paris Water Supply.

The water service in Paris is expected to come to the relief of the suburbs in cases of emergency by supplying as much water as is necessary to make up for temporary deficits, but while Paris has not too much water for its own needs during the hot summer months, the requirements of the suburbs are rapidly growing. There are 140 communes which have grouped for the putting down of pumping and filtration plants and laying mains, and while existing works at Choisy, Neuilly-sur-Marne, and Saint-Denis have been extended, a new plant is to be installed at Vitry, all of them drawing water from the Seine. So enormous is the volume of water now taken from the river that there is question of constructing a barrage to prevent the level from falling unduly. The supply at present is wholly inadequate, and the provision for drawing additional water from the Seine is hardly doing more than keep pace with the growing suburban population. The time will come when the population will again outstrip the river supply.

Destroyers.

The destroyer "Epervier," the sixth of the "2480-ton" class, has been put on the stocks at Lorient. Its turbines will develop 70,000 shaft horse-power, and the vessel is designed for a speed of 38 knots. Its armament will consist of five guns of 138 mm., one of 75 mm., four anti-aircraft guns, four Thornycroft mortars for depth charges, and six torpedo tubes. Electric welding will be largely used in its construction. This method is also employed on the lighter plating of the cruiser "Dupleix" at Brest, the heavier plates being riveted.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

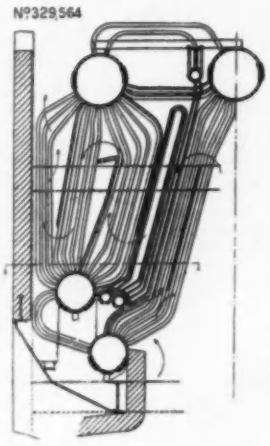
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

329,564. July 16th, 1929.—WATER-TUBE BOILERS, *The Stirling Boiler Company, Ltd.*, 32, *Farringdon-street, London, E.C.* 4.

It is claimed for the boiler which is described and illustrated in this specification that it will be readily differentiated from the previously proposed construction of Yarrow type boilers. The boiler illustrated may be described, broadly, as being one of the Stirling type, having a plurality of steam and water drums

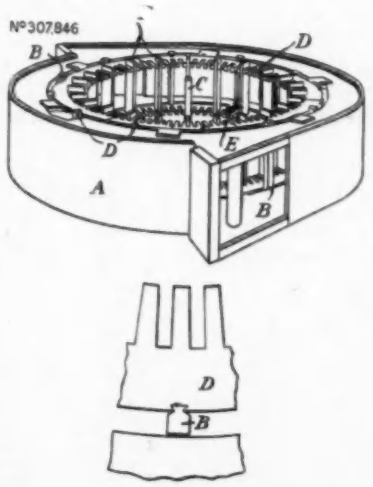


and a plurality of mud drums connected by banks of tubes, means for passing hot gases across those tubes, a baffle between the mud drums, and a superheater between the banks of tubes. The superheater has headers on the other side of the baffle from the gas pass. The construction of the boiler is so obvious in the drawing that no further description is necessary.—*May 22nd*, 1930.

DYNAMOS AND MOTORS.

307,846. March 14th, 1929.—STATORS FOR DYNAMO-ELECTRIC MACHINES, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

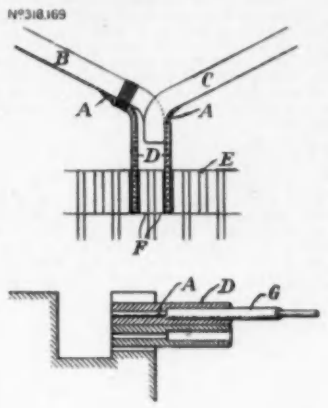
The stator described in this specification comprises a frame A having lamination supporting ribs B. In assembling the stator, the frame A is placed on the floor of the workshop and a shaft C is placed in the centre. After the laminations and ribs have been arranged in the machine, they are centred with respect to the axis of the stator by a pin gauge which is placed between the ends of the lamination teeth and the shaft C. This results in the ribs B being spaced from the frame A, and they are then



welded in position. After the ribs have been welded to the frame, the bundles of laminations D E are removed from the ribs and the laminations can be stocked in the frame in the usual manner. Instead of using bundles of laminations D and E, however, all the laminations that are to be used in the machine can be stacked in the frame on the ribs B and bars F, and be centred in the manner described above. In constructing a machine in this way, after the bars B have been welded to the frame it will only be necessary to remove the plates F and clamp the laminations in the machine between the clamping plates in the usual manner.—*May 22nd*, 1930.

318,169. July 5th, 1929.—COMMUTATOR CONNECTIONS FOR DYNAMO-ELECTRIC MACHINES, Maschinenfabrik Oerlikon, of Oerlikon, near Zürich, Switzerland.

In direct-current high-tension series motors, such as are used as auxiliary motors in electric railway work, the ends of the wires to be attached to the collector are very thin, the diameter of the bare wire ends being, for example, 0·7 mm. in a 1500-volt, 6 H.P. motor. It often happens therefore that owing to the mechanical shocks in switching-on the motor, and owing to the vibrations encountered in railway work, the commutator connections which have been still further weakened by soldering, break off. The invention aims at avoiding breakages of this kind. The wires A of the branches B and C of the winding to be connected to the commutator segments project into sleeves D, which, in turn, are inserted into and soldered to slots E of the segments. The sleeves consist of copper or brass, and may, if

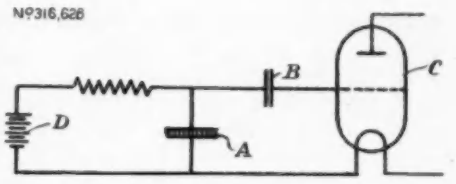


desired, be tinned, so that they need only to be heated in order immediately to establish a solid conductive connection on being assembled with the other members F and A. The internal diameter of the sleeve D is increased along part of the length of the sleeve, so that the diameter corresponds in part to the wire A and in part to the insulation G on the wire.—*May 22nd*, 1930.

TELEGRAPHS AND TELEPHONES.

316,628. August 1st, 1929.—A PROCESS FOR STABILISING NON-CRYSTALLINE, PIEZO-ELECTRIC MICROPHONE PLATES, Telefunken Gesellschaft für drahtlose Telegraphie m.b.H., of 12–13, Hallesches Ufer, Berlin.

By allowing certain materials to cool under the action of high-tension direct current, plates can be made which have such good piezo-electric properties that they can be used as efficient microphones. The materials chiefly employed for forming such plates are resins and waxes. Powder of a piezo-electric substance, for example, quartz, is preferably added to these materials. Some of these materials have the property that their piezo-electric moment diminishes with time. Experiments have shown that

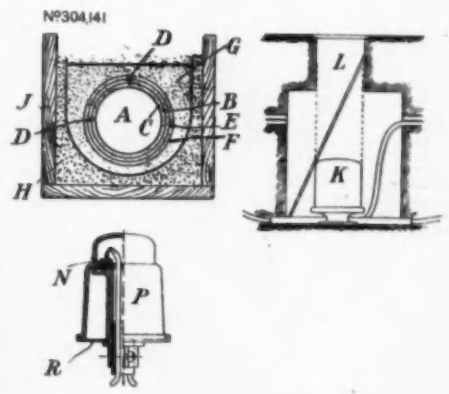


this reduction of the piezo-electric moment can be stopped or completely suppressed by continuously applying a direct-current potential to the piezo-electric body. The drawing shows diagrammatically how the invention may be carried into effect. A is a microphone plate, B a blocking condenser which prevents the stabilising voltage from the battery D from affecting the amplifying valve C. The condenser B is so dimensioned that it allows the alternating voltages caused by the response of the microphone plate A to act without appreciable interference on the valve C. The polarity of the battery voltage must be chosen according to the kind of the piezo-electric bodies used.—*May 22nd*, 1930.

TRANSMISSION OF POWER.

304,141. January 14th, 1929.—PROTECTIVE SYSTEMS FOR UNDERGROUND ELECTRIC CABLES, Società Anonima Roberto Ardigo Brevetti I.G.S., of 14, Via G. Pascoli, Milan, Italy.

According to this invention, protective systems are provided for underground electric cables, against the effects of stray currents and chemical or electric action of the ground. The cable A to be protected is wound with one or more insulating layers B applied to the lead sheath C, and on these layers one or more pilot or testing wires D of constant diameter or cross section and resistance are laid, these wires being arranged lengthwise



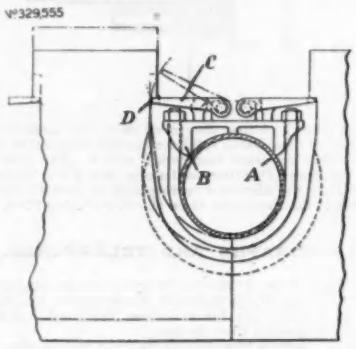
and extending throughout the whole cable length. The wires D are held in place by twine or tapes E made of cotton or other absorbent, but otherwise non-conducting material. Over the tapes E further layers F of insulating material are applied and the whole is embedded in plastic bitumen G poured into lengths of metal troughing, which, in its turn, is embedded in a suitable insulating material or mixture H contained in lengths of wooden troughing J, buried in the ground and protected in any suitable manner. Along the route of the cable, inspection chambers L are arranged at set distances, wherein the cable joint is made and then protected with a bell-shaped box K. At intervals along

the cable, joints of the testing wires D can be made, the wire ends being secured to terminals N mounted on a sleeve which is carried by arms that may be secured to the walls of the inspection chambers. The joint is protected by a bell-shaped box P, the bottom end of which may be closed by a diaphragm R. The testing wires D are intended to fulfil four duties:—(1) To permit measurements of the insulating value of the whole protecting system; (2) to signal, by means of measurement, when the insulation is lowering in value; (3) to localise the point where the diminution of insulating power of the protective system occurs, owing to the absorption power of the winding E, which, when once reached by a leakage, quickly brings it into contact with one of the wires D; (4) to permit of telephone communication between the operators at either end of the wire.—*May 14th*, 1930.

FURNACES.

329,555. June 27th, 1929.—FURNACE ARCHES, H. J. Taylor, Trelorne, Uxbridge-road, Hatch End, Middlesex, and C. E. Robinson, 40A, St. John's Wood-road, London, N.W.

The object of this invention is to provide an easy means of replacing the refractory bricks of furnace arches without disturbing the adjacent bricks. The arch is supported by a series

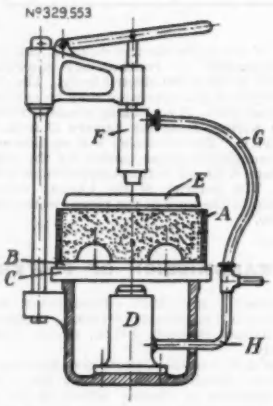


of water-cooled tubes A on the top of which there are bolted saddles B. These saddles carry pauls or triggers C, which engage with ledges D in the bricks, and thus support them. If it is required to replace a brick it is raised slightly, when the pauls can be disengaged and the brick taken out downwards.—*May 22nd*, 1930.

MACHINE TOOLS AND SHOP APPLIANCES.

329,553. June 25th, 1929.—MOULDING MACHINES, M. Grindal, Motala Verkstad, Sweden.

The inventor suggests the simultaneous hammering of plates on the top and beneath a moulding flask for the purpose of consolidating the sand. The flask is shown at A, with a mould B and bottom plate C. This plate is operated upon by the pneu-

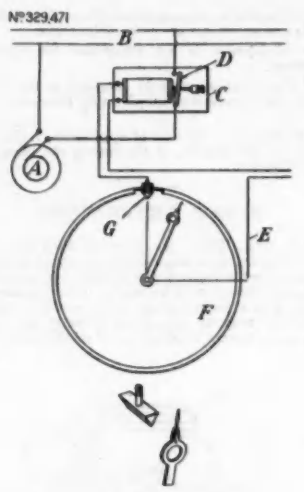


matic hammer D, while a plate E, put upon the top of the mould, is struck by the hammer F. This hammer is carried by a swinging bracket, so that it can be moved out of the way when the moulds are changed. It is suggested that by a proper proportioning of the air supply pipes G and H, the blows of the two hammers can be brought into synchronism, with a consequent increase in their effect.—*May 22nd*, 1930.

MISCELLANEOUS.

329,471. April 15th, 1929.—AUTOMATIC MEANS FOR SYNCHRONISING DYNAMO-ELECTRIC MACHINES, Daniel William Hute, of Salem, Ohio, U.S.A.

In the diagram A is the alternator and B the alternating-current bus-bars. D is a relay which is capable of closing the alternator circuit. Normally the armature D is held in the "off" position by a spring. After the alternator has been started, and the voltage and speed have been adjusted, it is allowed to run for a short period before the low-voltage circuit E is closed. When this circuit has been energised, however, the pointer of the synchroscope oscillates in the usual way, and when the



pointer makes contact with the flexible contact G, the coil of the relay is energised and the alternator is switched on to the bus-bars.—*May 22nd*, 1930.

329,500. May 11th, 1929.—DASHPOTS FOR WEIGHING APPARATUS, W. and T. Avery, Ltd., Soho Foundry, Birmingham, and C. McG. Sykes.

The idea of this invention is to provide a dashpot for weighing machines, which can be accurately adjusted as to its oil content before dispatch and will perform its functions there-

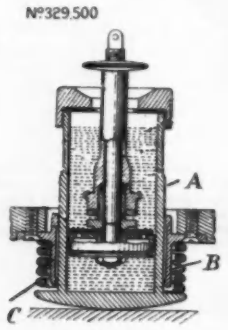


Fig. 1.

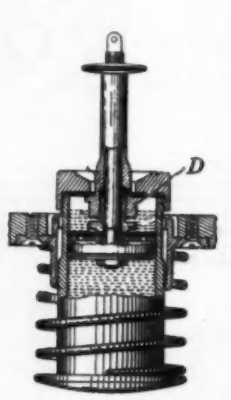


Fig. 2.

after without further attention. The casing A of the dashpot slides in a sleeve B attached to the base of the weighing machine. It is embraced by the helical spring C, which is compressed by the weight of the machine when it is placed on a platform—as shown in Fig. 1. If the machine is lifted the spring extends—see Fig. 2—and the flange D seals the oil container against the top cover.—*May 22nd*, 1930.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

F. W. BRIDGES AND SONS, Ltd., ask us to announce that they have transferred their offices from Avenue Chambers, 4, Vernon place, Southampton-row, W.C. 1, to Grand Buildings, Trafalgar-square, London, W.C. 2. New telephone number Regent 6861/2.

SIR S. GEORGE HIGGINS has been re-elected Chairman of Lloyd's Register of Shipping for the ensuing year, Mr. Arthur L. Sturge, Deputy-Chairman and Treasurer, and Mr. J. Howard Glover, Chairman of the Sub-committees of Classification.

THE WIGSTON FOUNDRY COMPANY, Ltd., of South Wigston, near Leicester, asks us to announce that its board has been reorganised with Mr. S. L. Wright as chairman and Messrs. Guy Barrett and W. Ralph Bates as managing directors, and that the programme of modernisation of its works, now in progress, includes the addition of new machine shops.

THOS. W. WARD, Ltd., of Sheffield, have acquired the undertaking and assets of the Midland Coal, Coke and Iron Company, Ltd., Apedale, Staffs., comprising a freehold estate of over 2000 acres, together with coal and mineral rights, collieries, blast-furnaces, coke ovens, by-product plant, foundry, sawmills, machine shops, brickworks, farms, 200 houses and Apedale Hall. The ironworks have been in existence for over 200 years and coal has been mined on the estate for centuries.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Meeting at Wandsworth and Heston Air Park. Assemble at Streatham Baths. 10.45 a.m.

TO-DAY AND SATURDAY, JUNE 28TH.

ROYAL SANITARY INSTITUTE.—Congress and Health Exhibition at Margate.

MONDAY TO FRIDAY, JUNE 30TH TO JULY 4TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Summer Meeting at Bristol.

MONDAY, JULY 7TH.

ROYAL INSTITUTION.—21, Albemarle-street, W. 1. General Meeting. 5 p.m.

WEDNESDAY TO WEDNESDAY, SEPTEMBER 3RD TO 10TH.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Bristol meeting. The presidential address, by Professor F. O. Bower, will deal with "Size and Form in Plants." Evening discourses will be given by Professor E. V. Appleton, F.R.S., on "Wireless Echoes," and by Dr. R. E. Slade on "The Nitrogen Industry and our Food Supply." Evening receptions and excursions to points of scientific interest, works, &c., in the locality will be arranged.

THURSDAY TO SUNDAY, SEPTEMBER 4TH TO 7TH.

INTERNATIONAL CONGRESS OF CONSULTING ENGINEERS.—Fifth Congress at Vienna.

CONTRACTS.

WILLIAM BOBY AND CO., Ltd., have received an order from the York Street Flax Spinning Company, Ltd., of Belfast, for one of their "Simplex" type lime-soda water softening plants, having an hourly capacity of 12,000 gallons.

ROBERT STEPHENSON AND CO., Ltd., of Darlington and 25, Victoria-street, Westminster, S.W. 1, have received an order from the Buenos Aires and Pacific Railway Company for fifteen 0–8–0 type tank locomotives, approximate full weight 65 tons, approximate light weight 53 tons.

THE ENGLISH ELECTRIC COMPANY has received an order from the Central Electricity Board for 16 units totalling 130,000 kVA and comprising six 10,000 kVA 66 kV transformers, two each for Kirkstall, Harrogate and York; two 10,000 kVA, 22 kV transformers for Huddersfield; four 7500 kVA, 33 kV units, two each for Peterborough and Barnsley; four 5000 kVA, 33 kV transformers, two each for Rotherham and Doncaster. Each unit will be complete with "English Electric" on-load tap changing gear. These transformers are for the Mid-East England scheme.

THE PATERSON ENGINEERING COMPANY, Ltd., of London, through its South African representatives, Blane and Co., Ltd., of Johannesburg, has received an order for the installation of ten water softening plants at the various watering stations on the Karoo section of the South African Railways, viz.:—De Aar (16,000 gallons per hour); Deelfontein (10,000 gallons per hour); Hutchinson (12,000 gallons per hour); Krom River (10,000 gallons per hour); Rhenosterkop (8000 gallons per hour) Beaufort West (10,000 gallons per hour); Prince Albert Road (8000 gallons per hour); Koup (8000 gallons per hour); Laingsburg (10,000 gallons per hour); Matjesfontein (8000 gallons per hour).

CANADA AND BRITISH IRON AND STEEL.—On Thursday, June 19th, the Executive Committee of the National Federation of Iron and Steel Manufacturers passed the following resolution: "This meeting of the Executive Committee of the National Federation of Iron and Steel Manufacturers, representing the whole of the British Iron and Steel Industry, desires to record its high appreciation of the recent action of the Dominion of Canada in according increased preferences to the products of this industry, and welcomes this indication of the desire on the part of Canada to increase industrial co-operation within the Empire, which marks an important step in the development of the policy of reciprocal agreements to the mutual advantage of the industries and the countries concerned."

COMMERCIAL EDUCATION.—A course of study in Industrial and Commercial Administration has been formulated by a Committee of Practical Business Men with a view to providing a comprehensive course of study in the principles and practice of business as a whole, as distinct from a detailed study of any single subject or section, at the Leicester College of Technology. The course differs therefore from the other courses provided in the College, in that it covers the whole field of industrial and commercial activity, treated in a broad manner, and is free from the trammels of examination regulations. It is intended for those who aspire to positions of responsibility in the management or administration of a business in which a wide knowledge of the fundamental principles of commerce is essential. Every effort will be made to relate the teaching to the actual practical problems of business life. Moreover, the aim will be to reveal the romance of business and to develop in the minds of the students an appreciation of the fact that a broad study of business and commerce can be an entrancing occupation. It is intended that the instruction in all sections of the courses shall proceed concurrently by stages, so that a general knowledge of commerce may be gained by the student.

END OF VOL. CXLIX.

Gears

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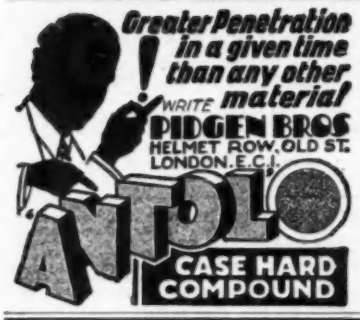

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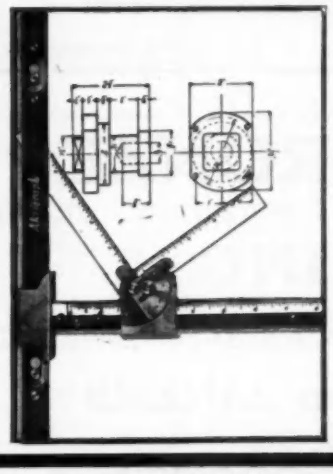

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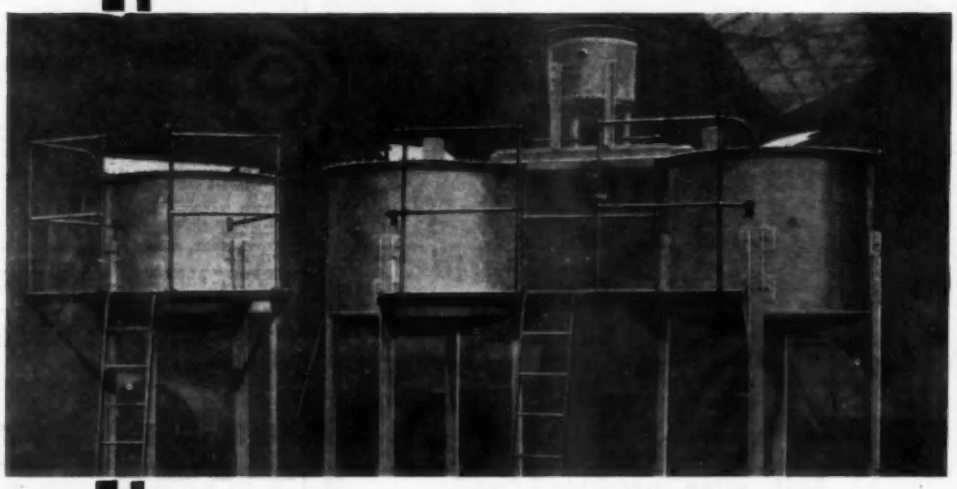

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BRITISH PATENTS No. 242,349 and 242,556, relating to liquid level indicators suitable for motor cars, motor boats and aeroplanes.
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THE PROPRIETOR of BRITISH PATENT No. 267,840, dated November 12, 1926, relating to "Improvements in a Mixing Machine," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 5230 H

THE PROPRIETORS of BRITISH PATENTS Nos. 202,319, 219,708, 267,117, 154,609, 213,602, 277,657 and 214,647, relating to cycle hubs, are DESIROUS of NEGOTIATING for the GRANT of LICENCE to WORK thereunder.—
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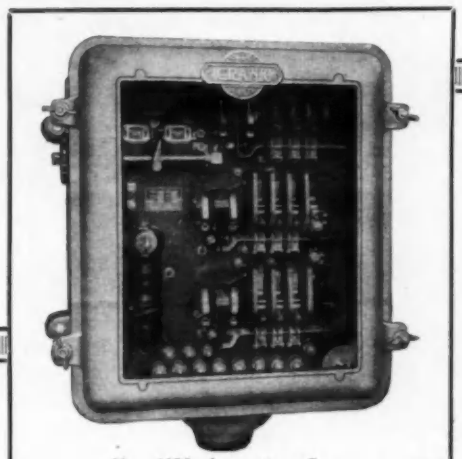

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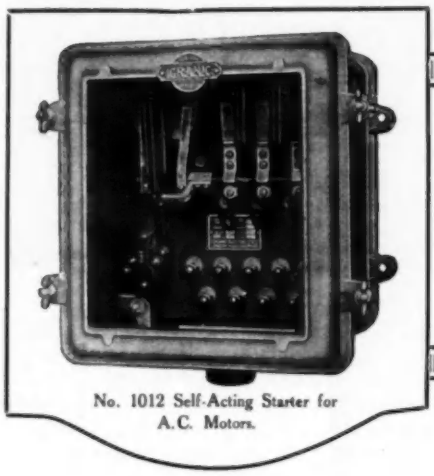

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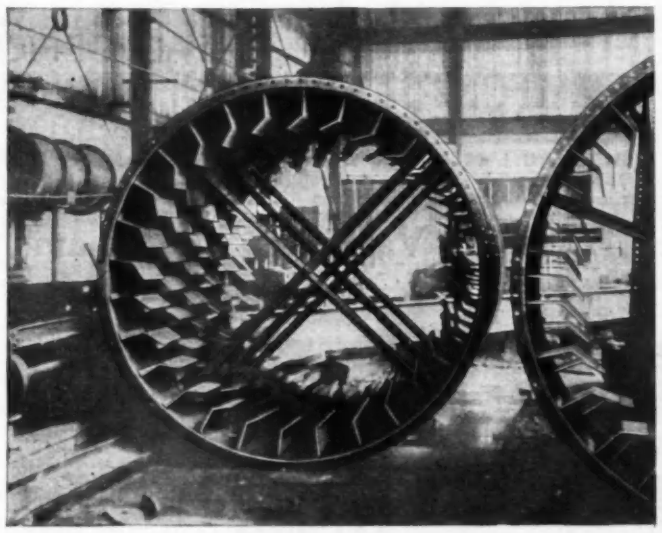

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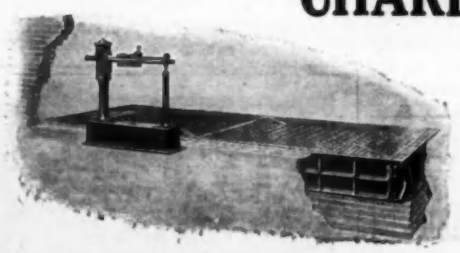

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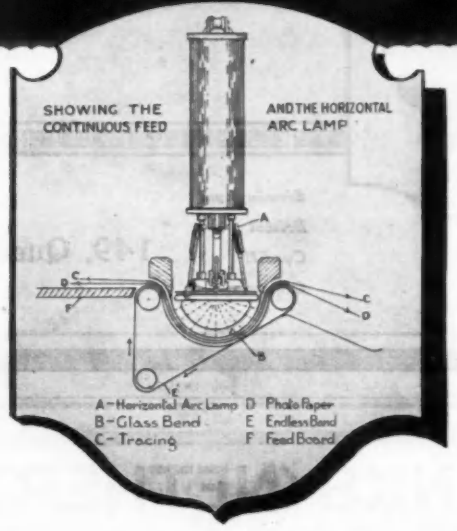

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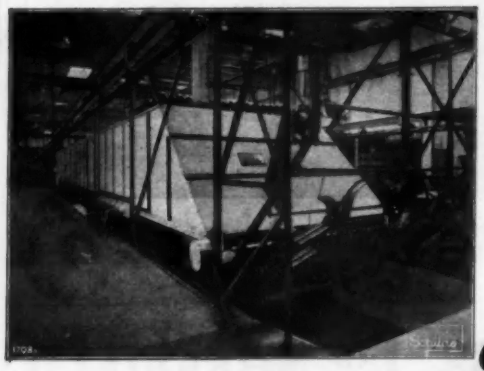

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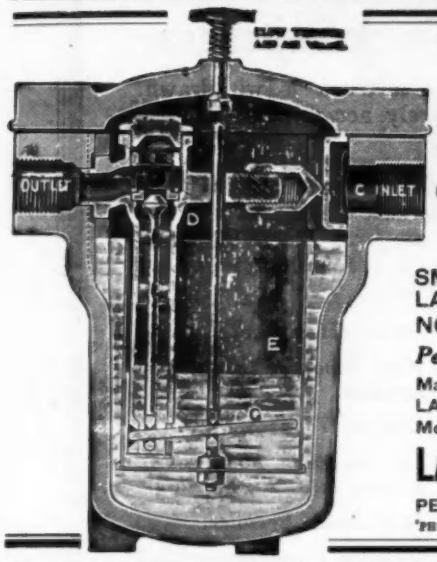

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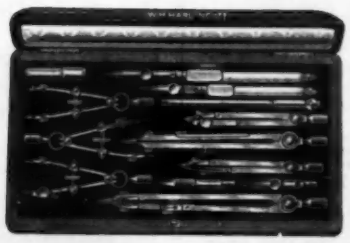

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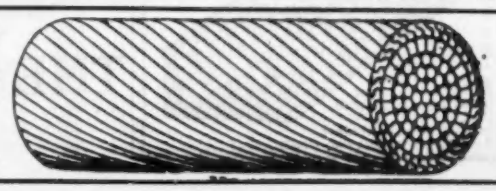

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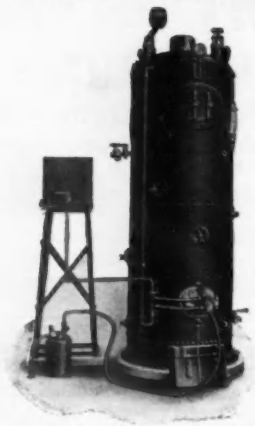

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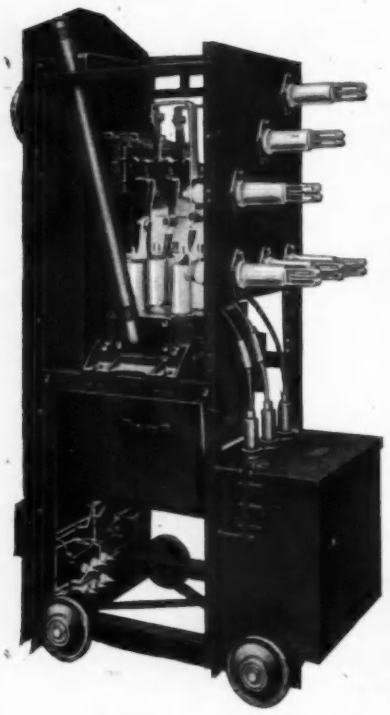

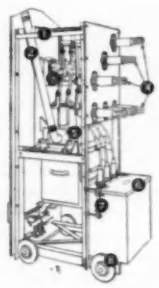

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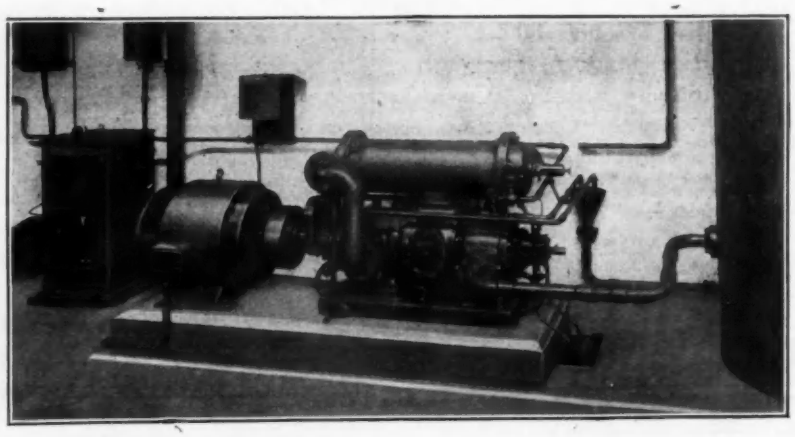

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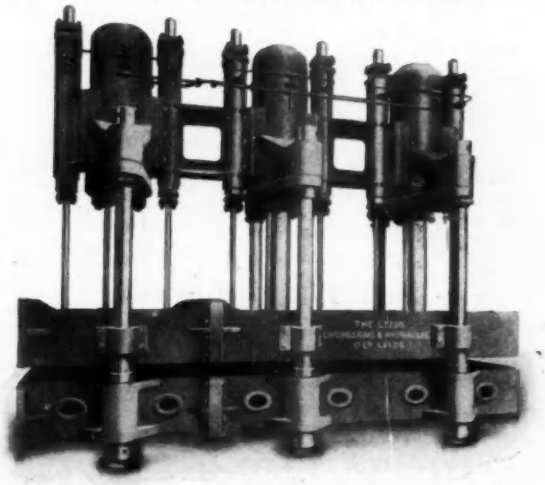

FIG. NO. 287—Total Power 400 tons, Table 16ft. 6ins. x 5ft. 0in.

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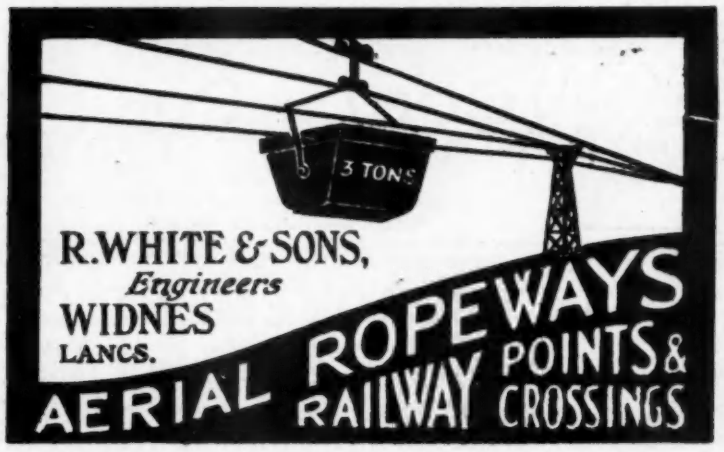

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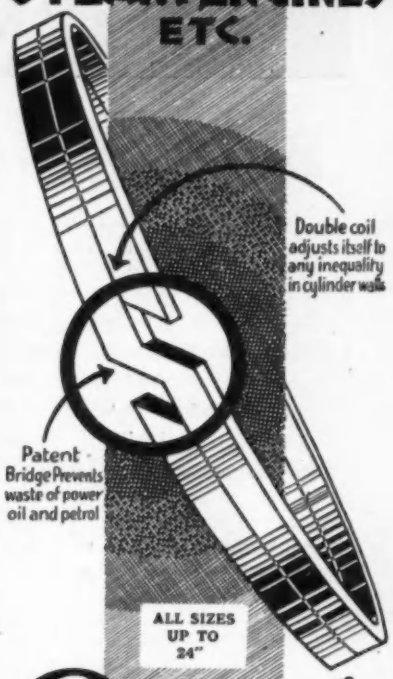
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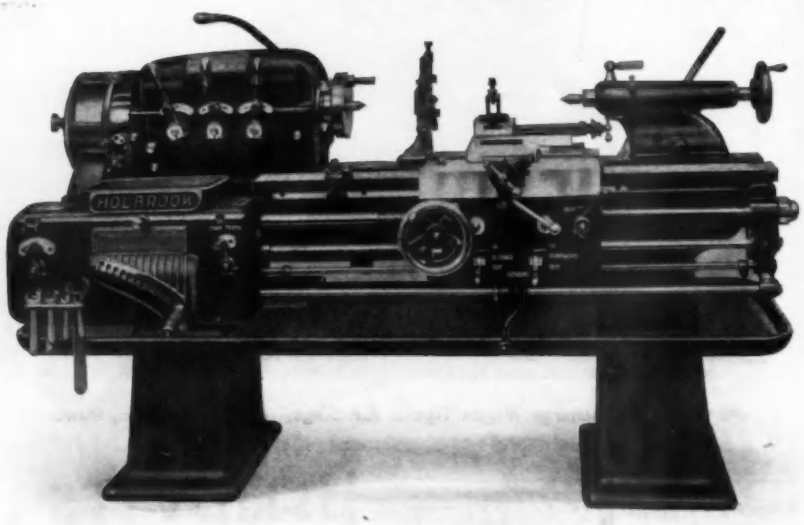

MODEL T No. 15 with single pulley drive.

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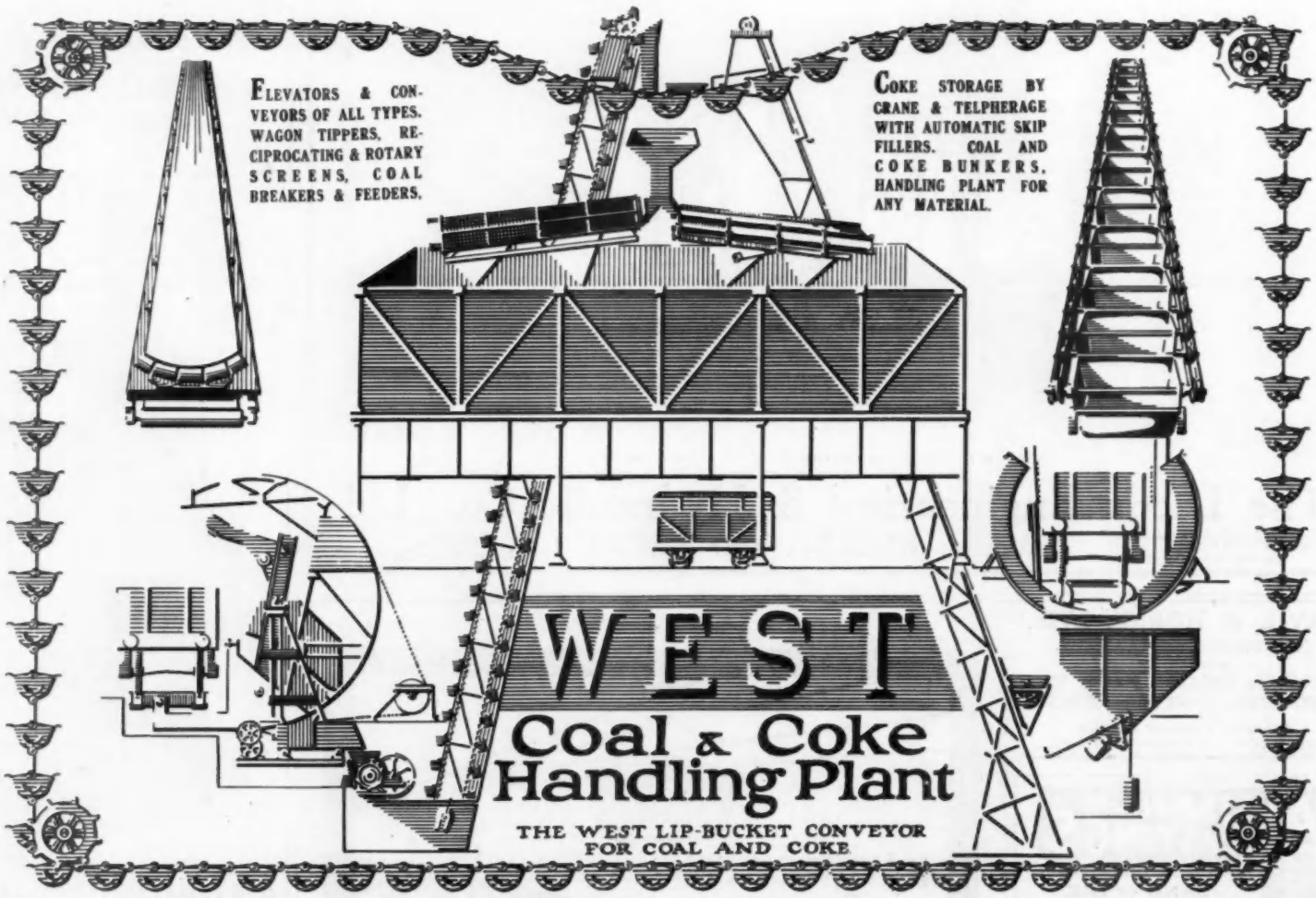
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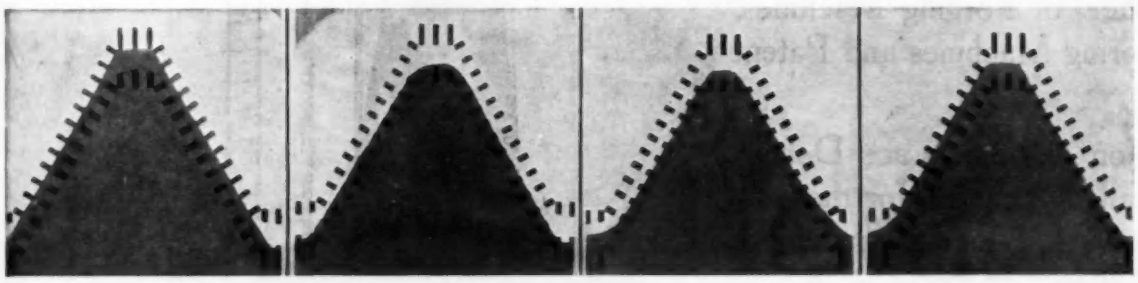

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Shadow of the smallest screw that will be acceptable by this chart. It is of correct lead.

A screw undersize on pitch diameter with a full root, would feel like a good fit in the average gauge.

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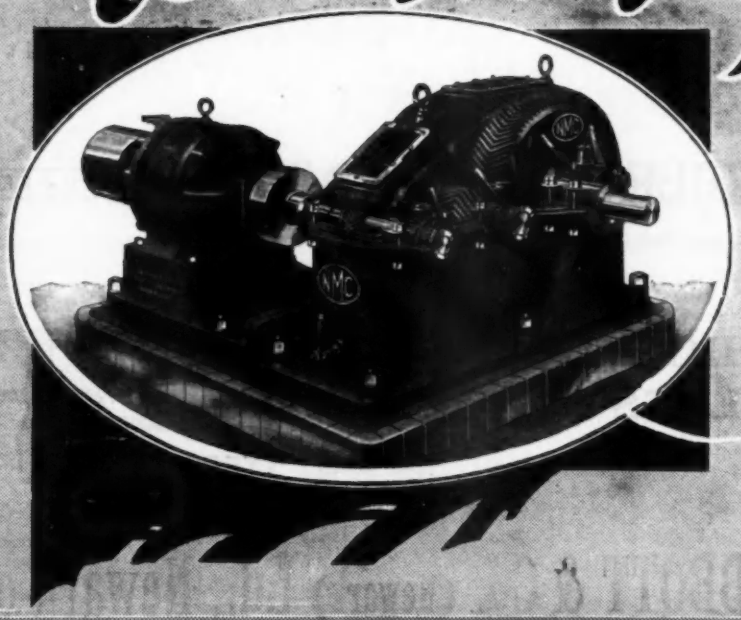

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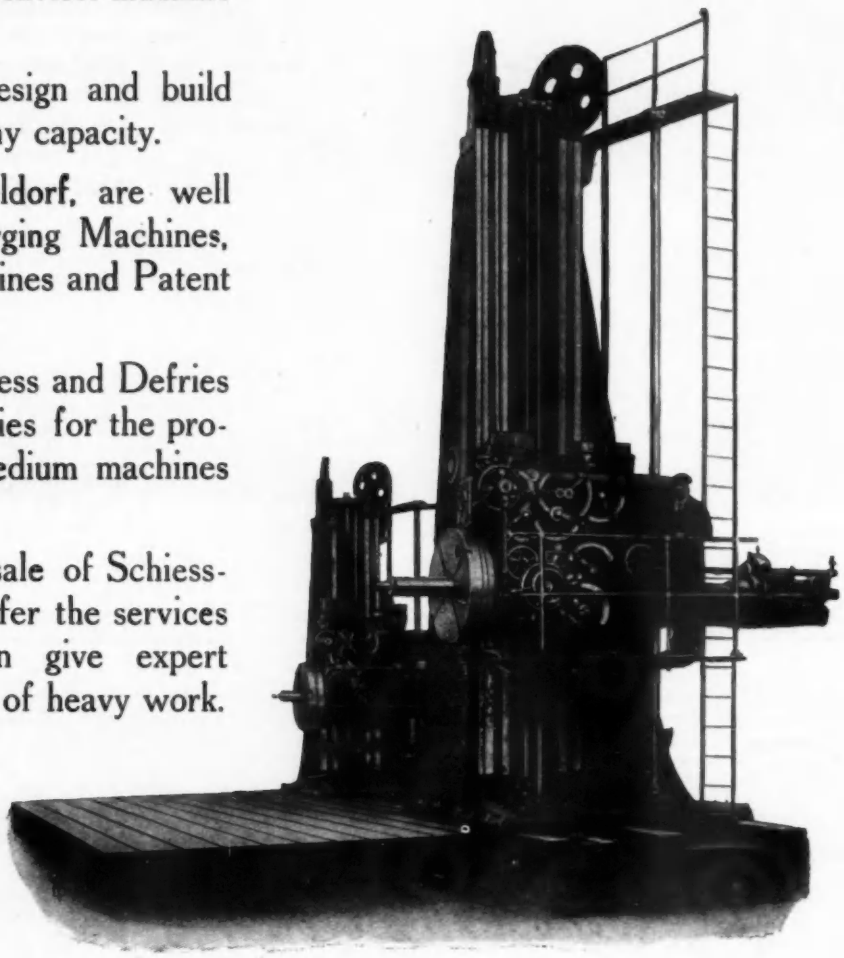

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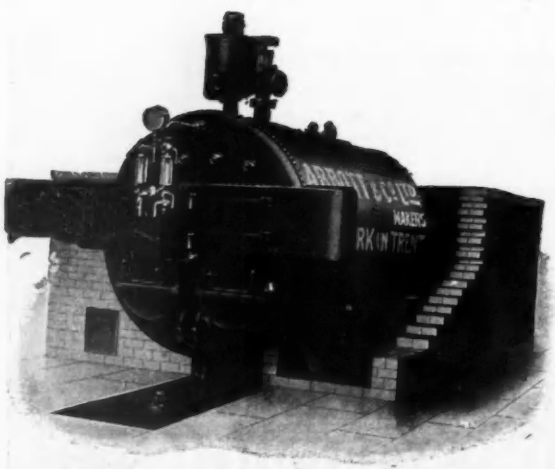

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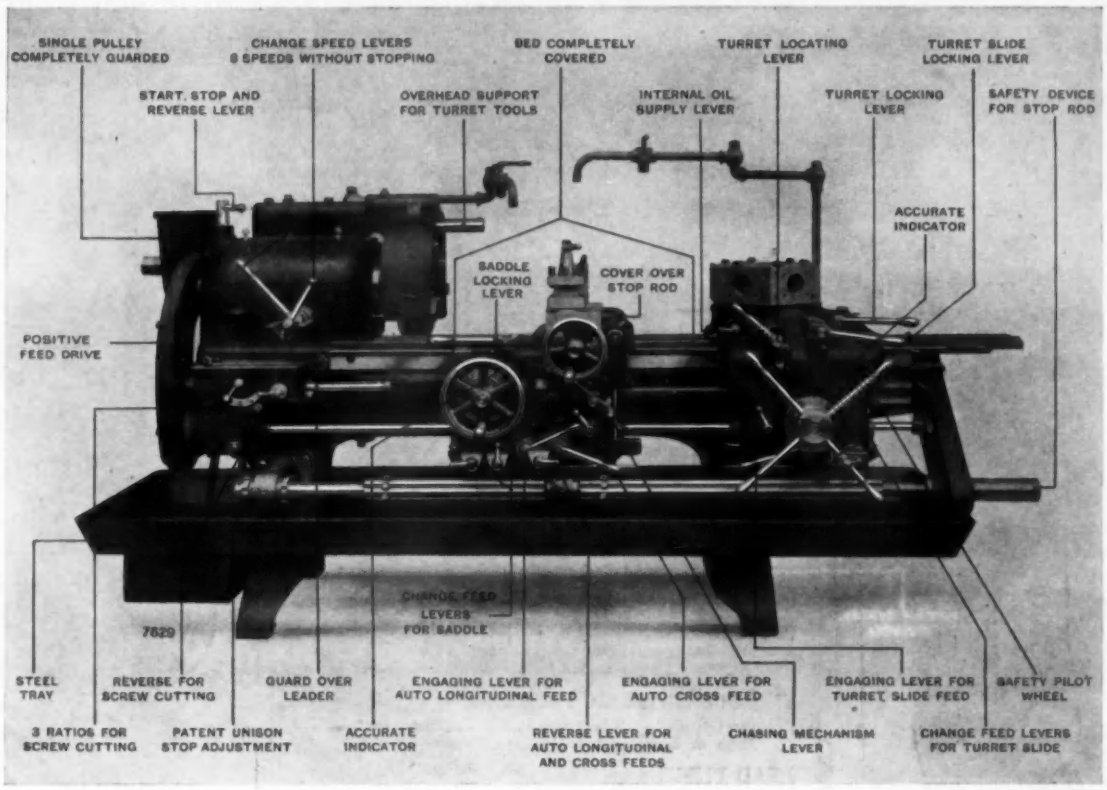
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SADDLE LOCKING LEVER
COVER OVER STOP ROD
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ENGAGING LEVER FOR AUTO LONGITUDINAL FEED
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ENGAGING LEVER FOR TURRET SLIDE FEED
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Diameter of hole through spindle...	2 1/16"		

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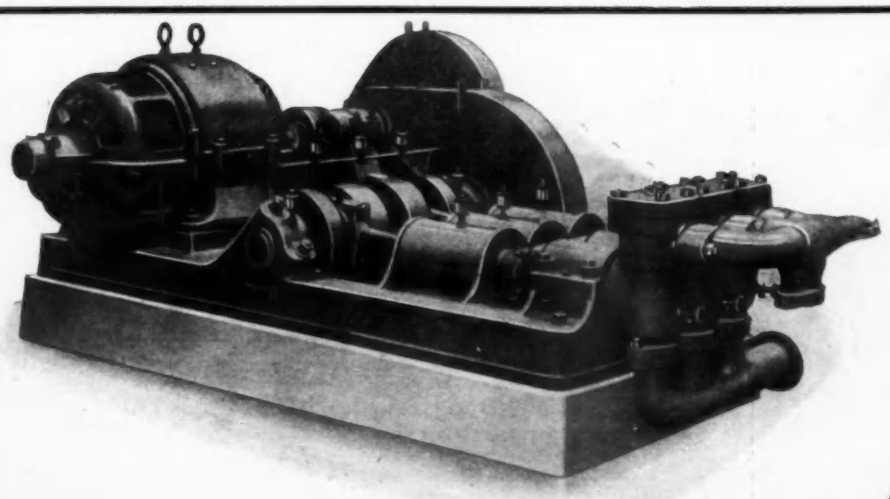

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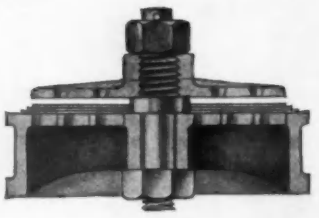

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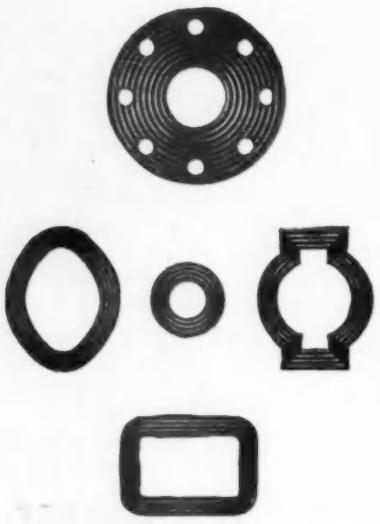

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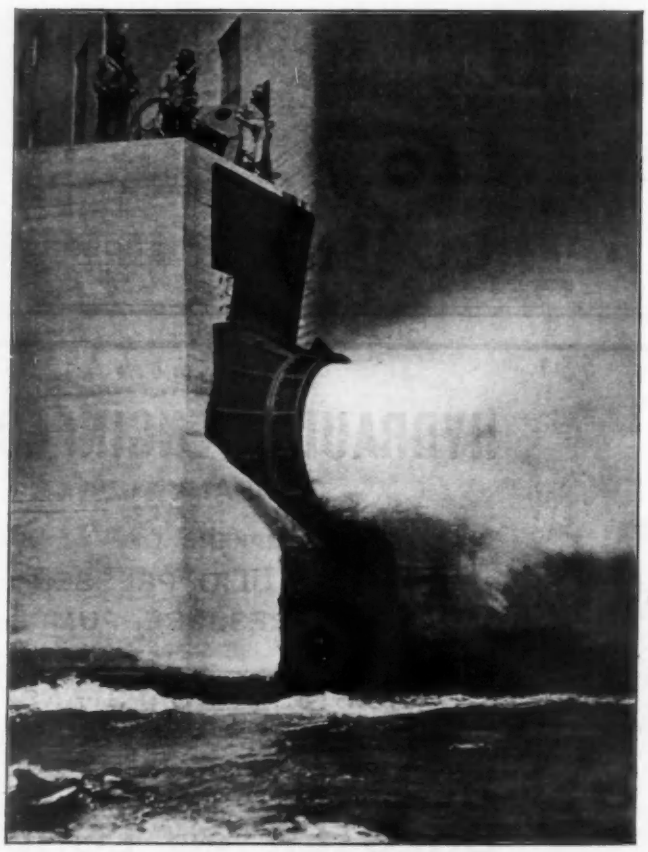

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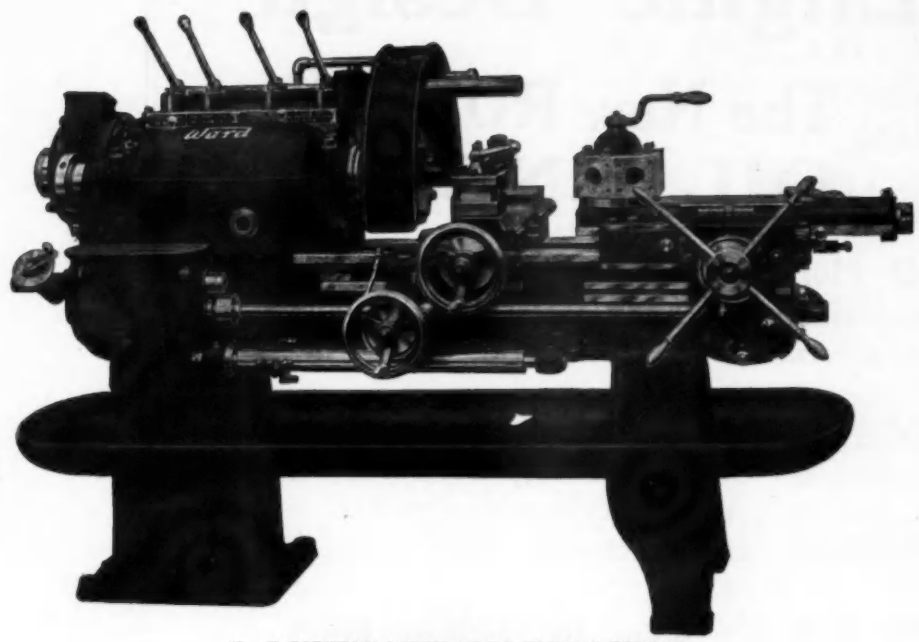

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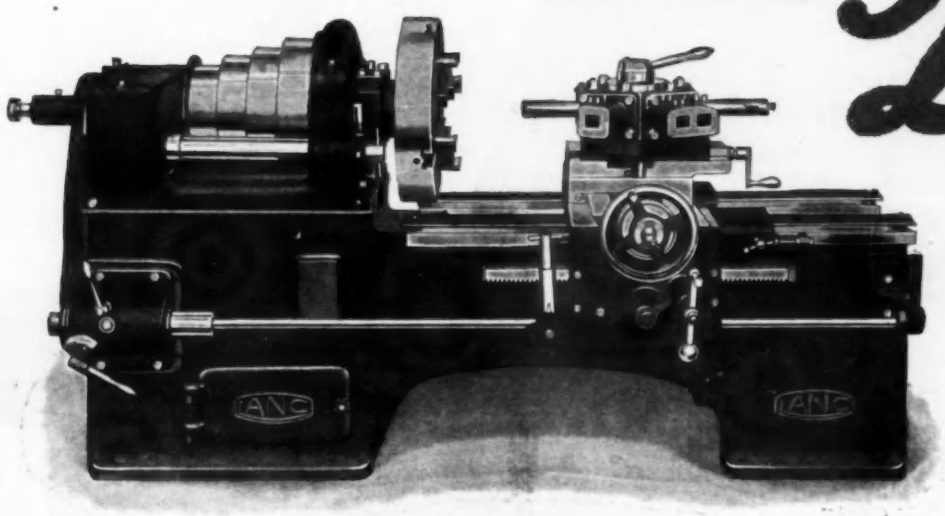

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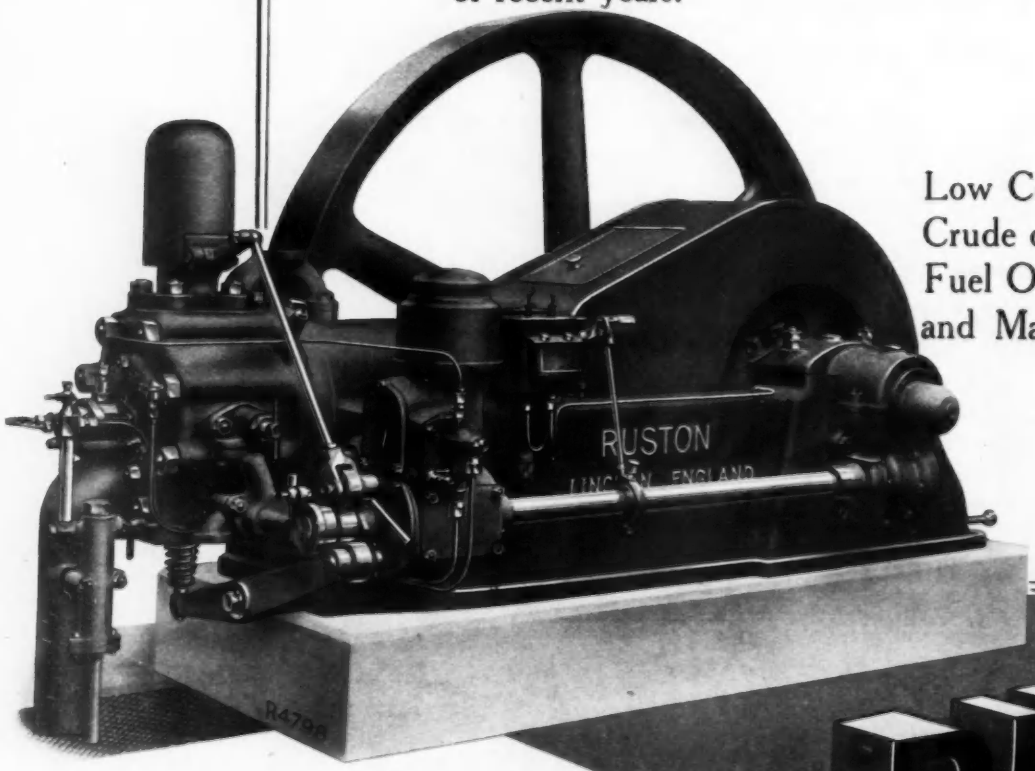

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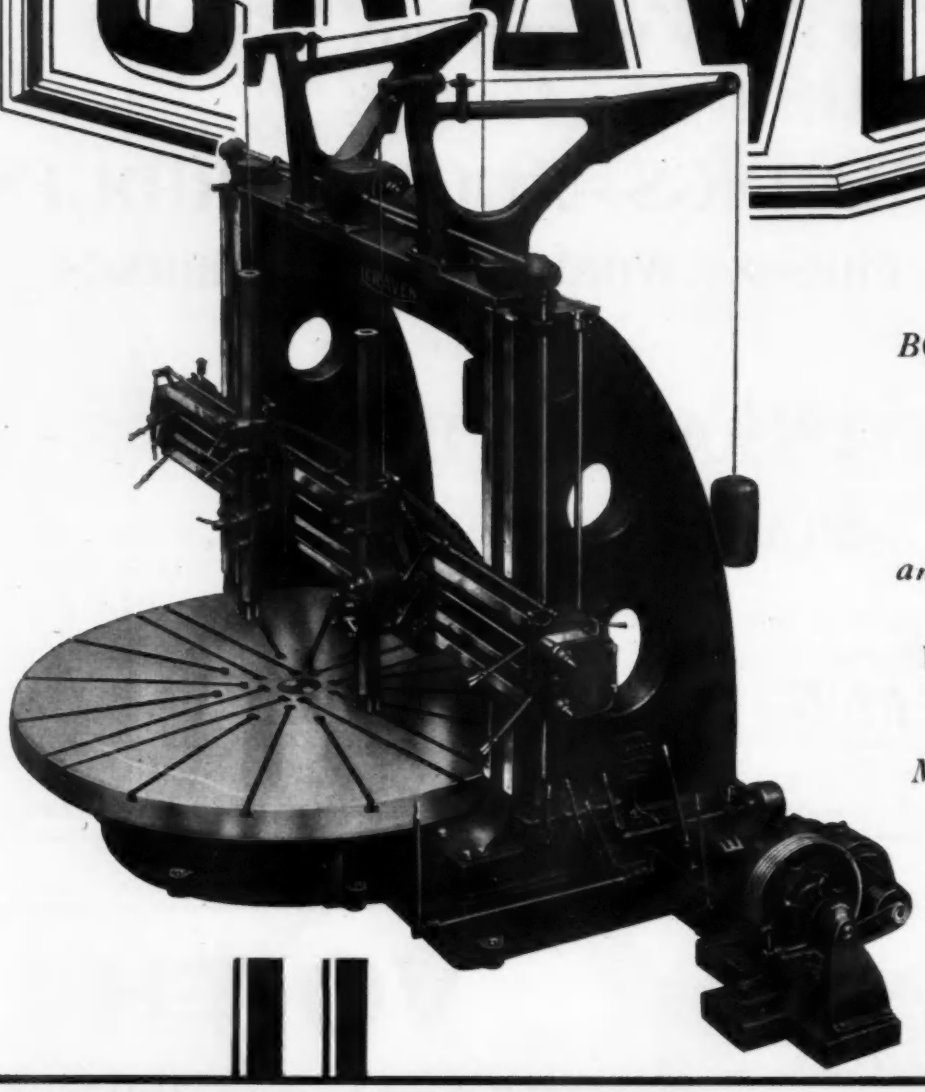

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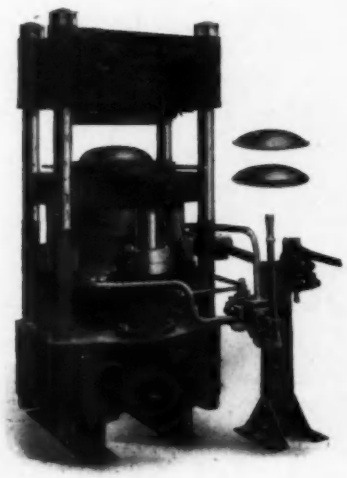

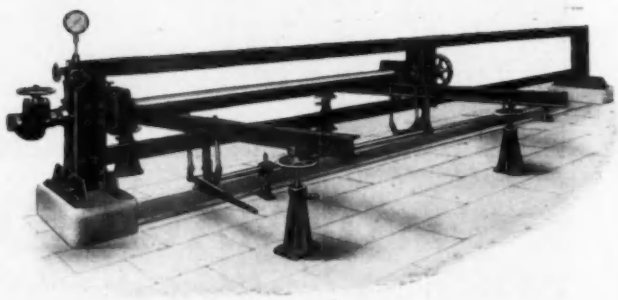

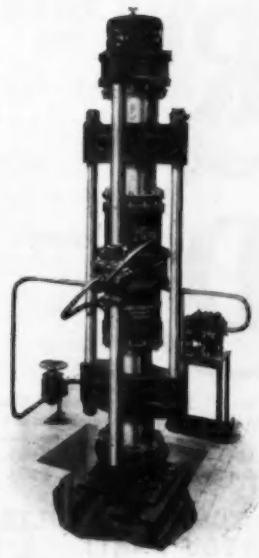

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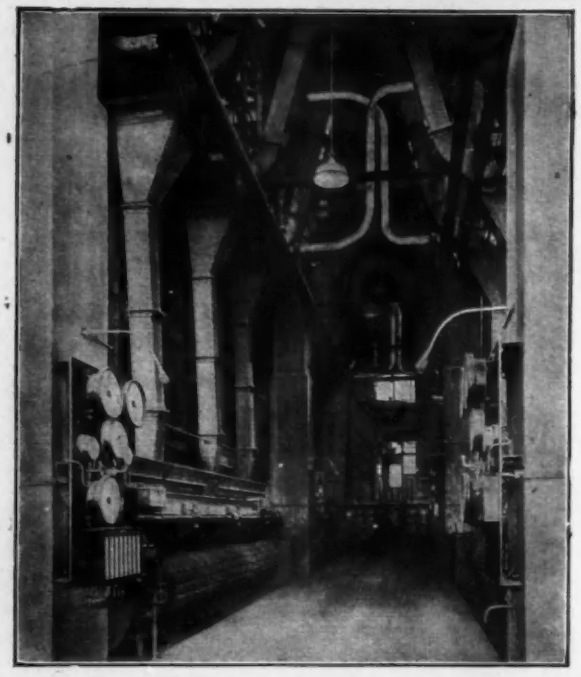

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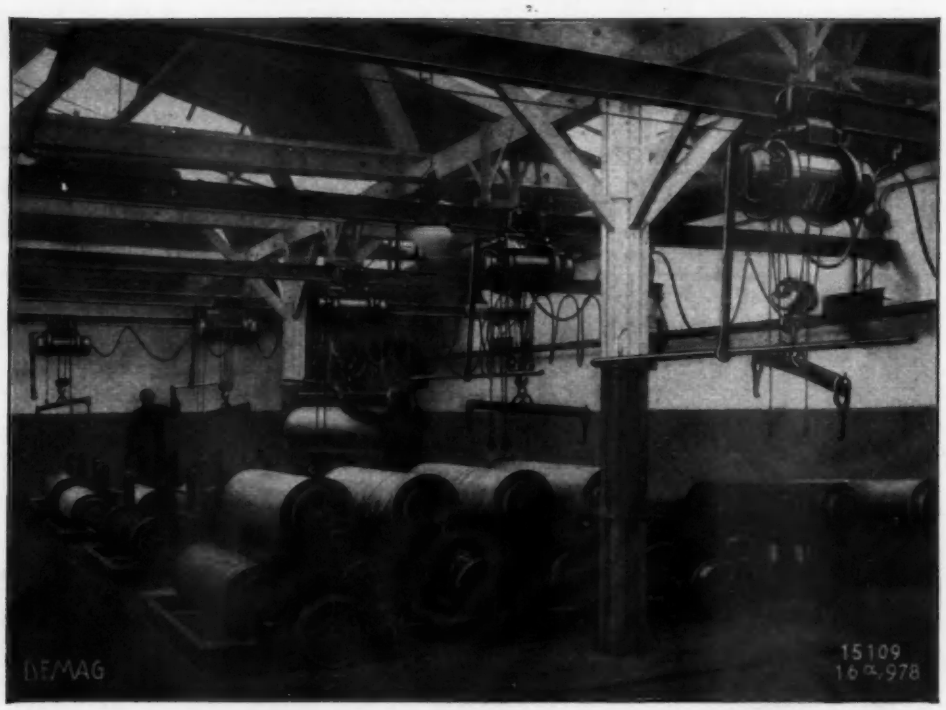

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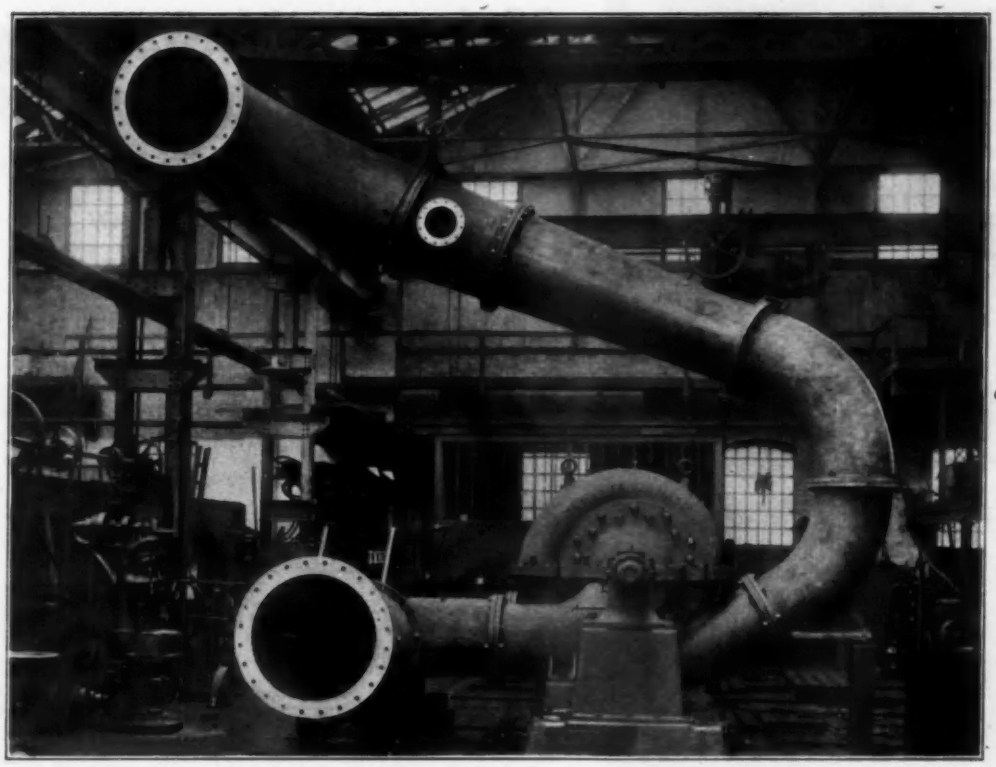

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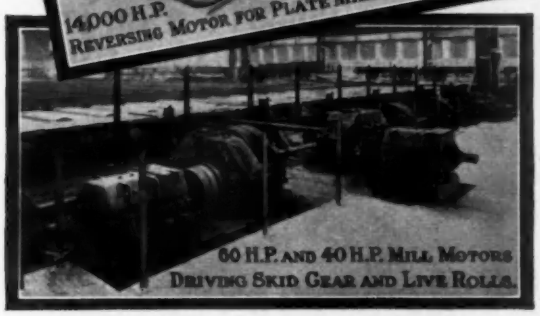

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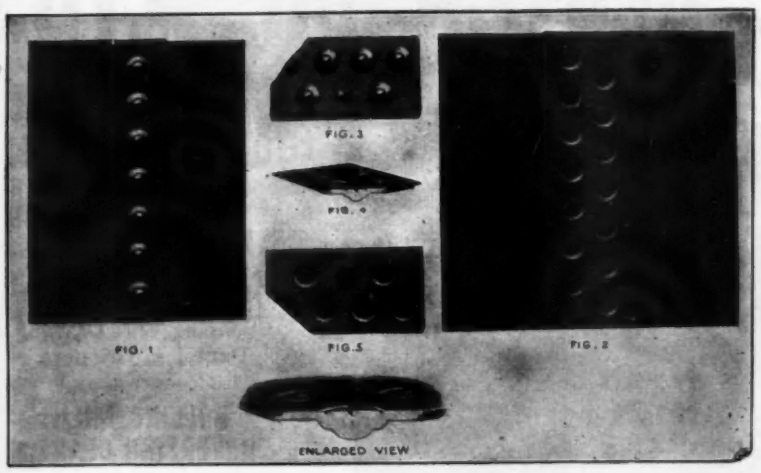

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CRANES
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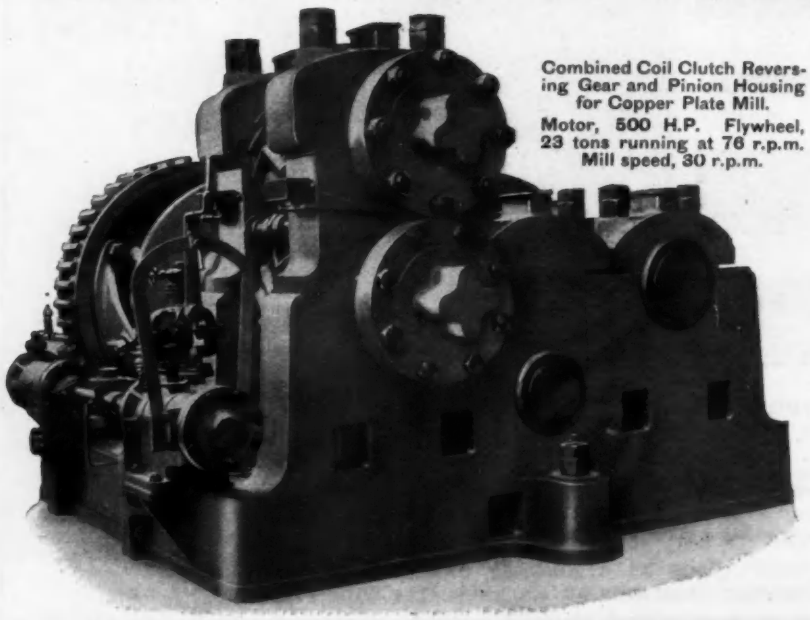

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Motor, 500 H.P. Flywheel, 23 tons running at 76 r.p.m. Mill speed, 30 r.p.m.

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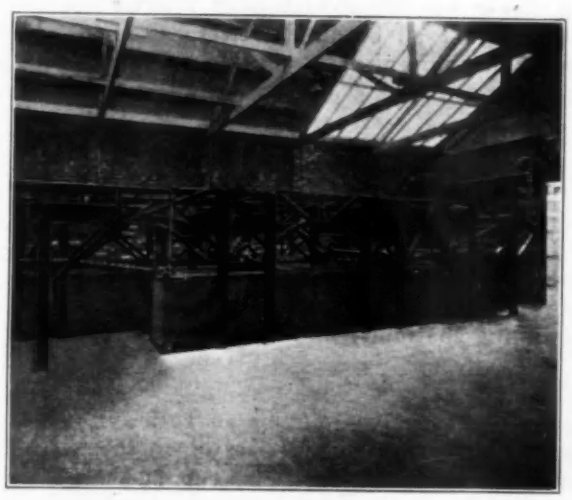
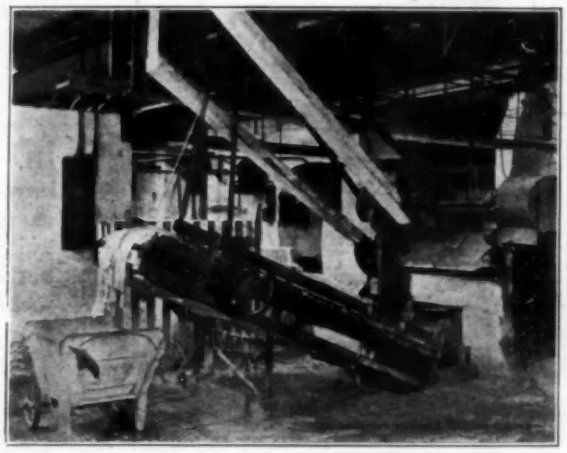
FOR ALL PURPOSES

A Portable Belt Conveyor for handling sacks, cases, etc.



A Conveyor specially designed by us for carrying castings through the acid, water and soda tanks during the pickling process. Similar types of Conveyors can be used for conveying articles through paint tanks and for similar treatment.



This illustration show a "B.B." Conveyor in use handling skins in a leather works and is an example of the many ways in which our Conveyors can be employed.

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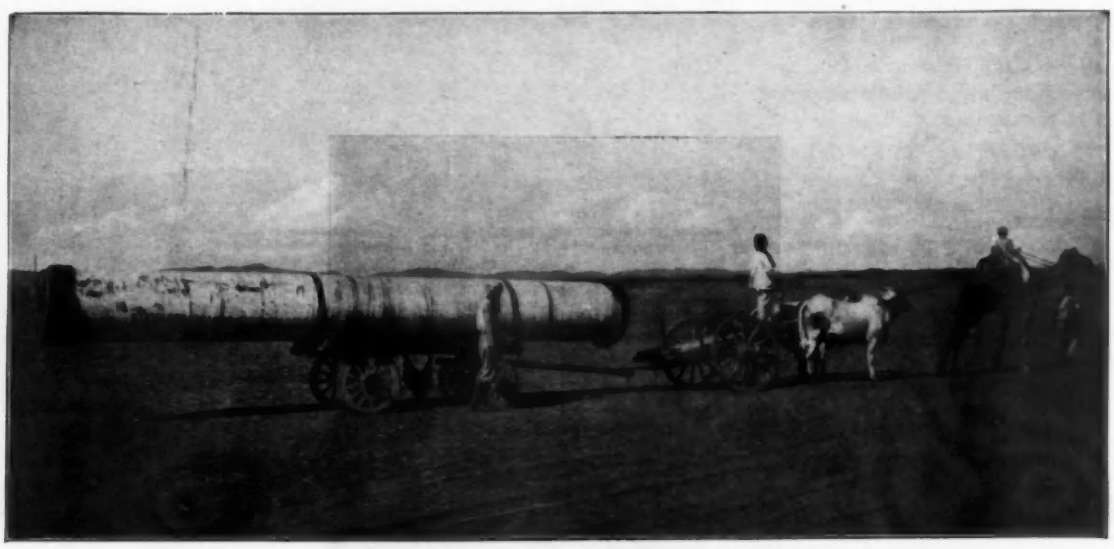
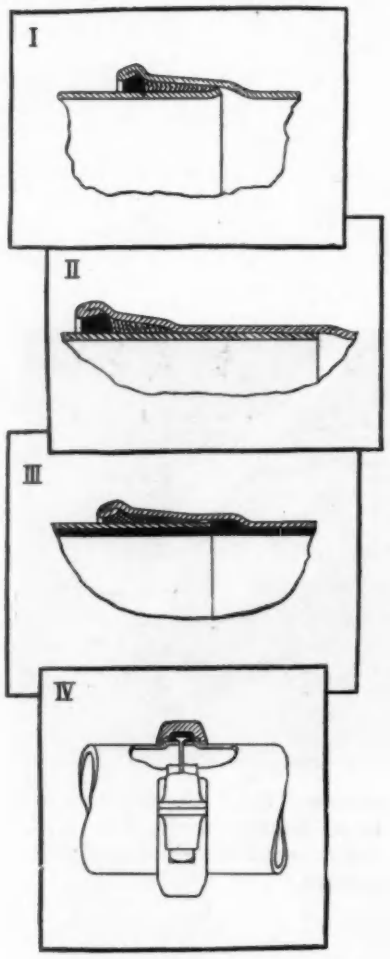
E 166.

STEEL WATER MAINS





The four joints illustrated are those most widely used on our steel tubes for water mains.

I.—The first is an adaptation of the spigot and socket cast iron pipe joint. The beaded edge gives great strength to the socket and prevents the lead and yarn being blown out by any ordinary pressures.

II.—The long sleeve on the second joint relieves the jointing material of all bending stresses. Considerable longitudinal movement is possible on this joint without leakage.

III.—The third joint owes its origin to our recently introduced bitumen lining. To obtain the full advantages of this protection it is essential that the lining should be continuous throughout. The spigot butts against the bituminous composition in the socket, thus ensuring continuity of the lining.

IV.—The fourth—the Victaulic Joint—is an entirely different type. It is suitable for all sizes up to 48" bore, and couples the tubes as securely as a flange joint while allowing expansion and contraction and angular movement to take place under full working load. The internal pressure seals the joint—the higher the pressure the tighter the joint.

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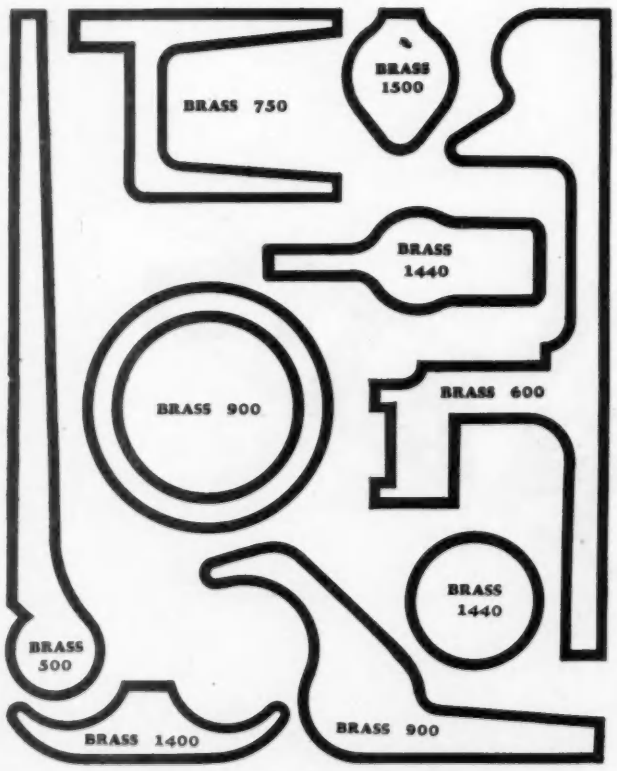
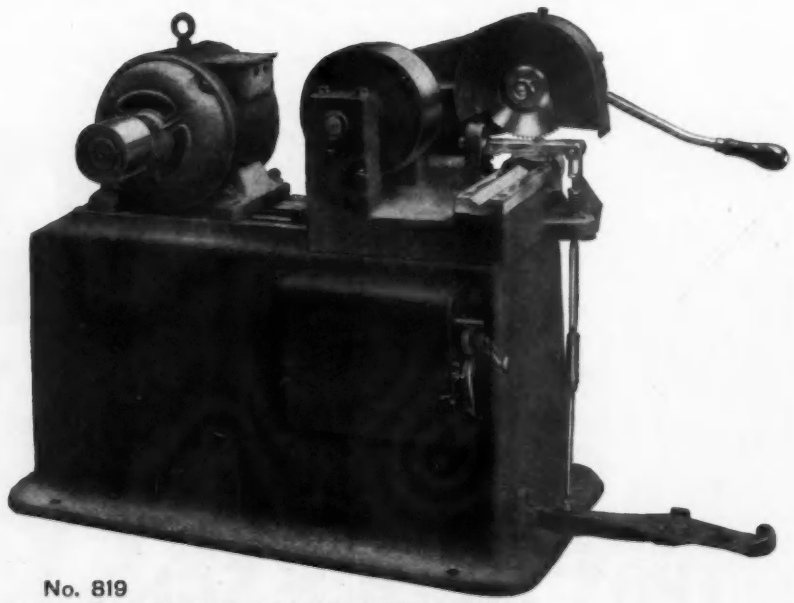


FULL SIZE SAMPLES WITH PRODUCTION RATES PER HOUR.



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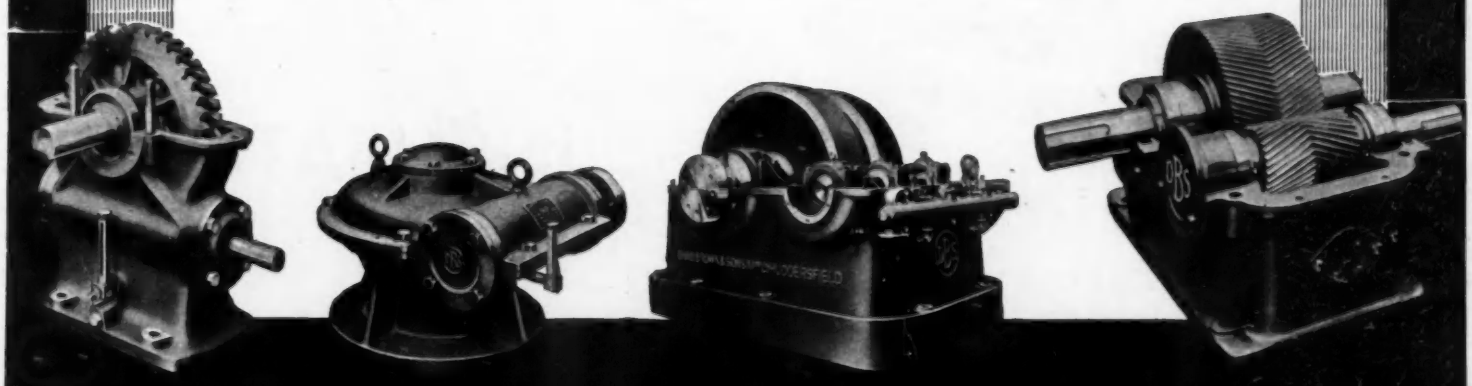

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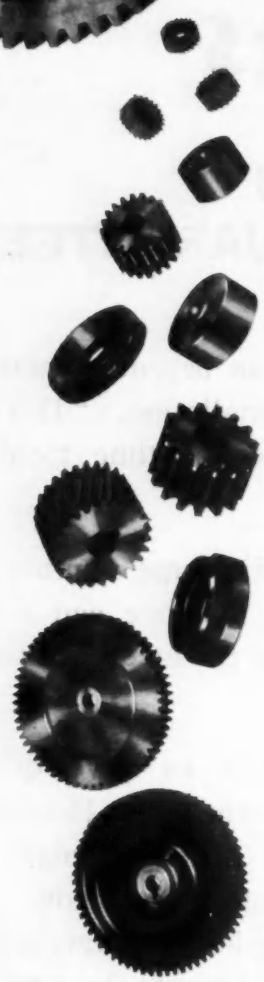

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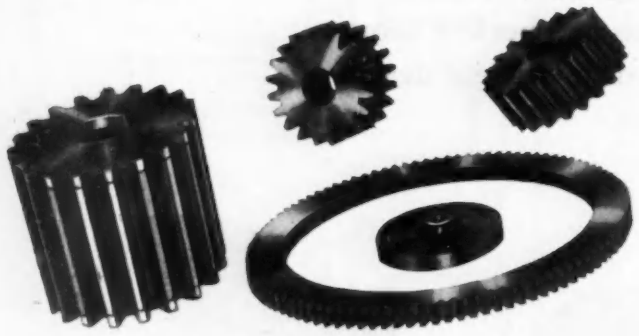

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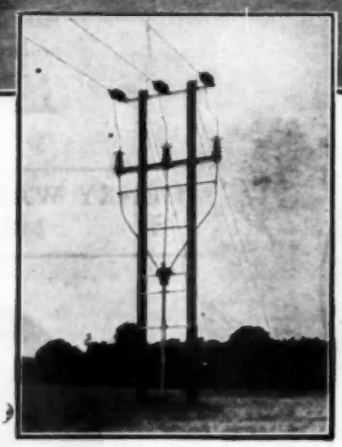

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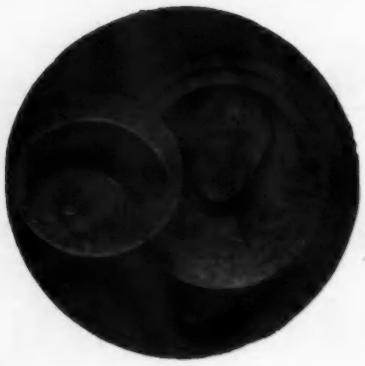

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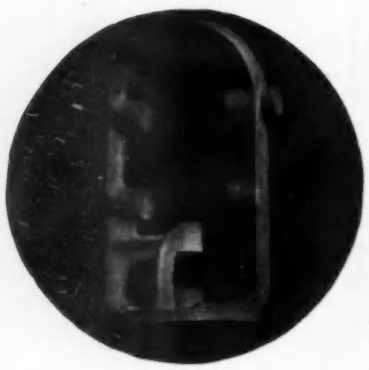

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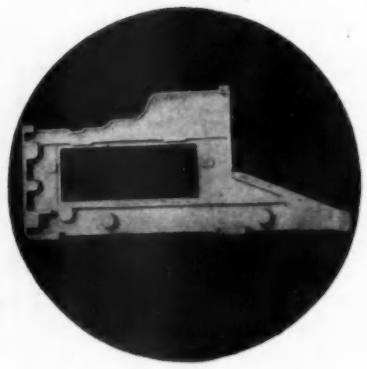

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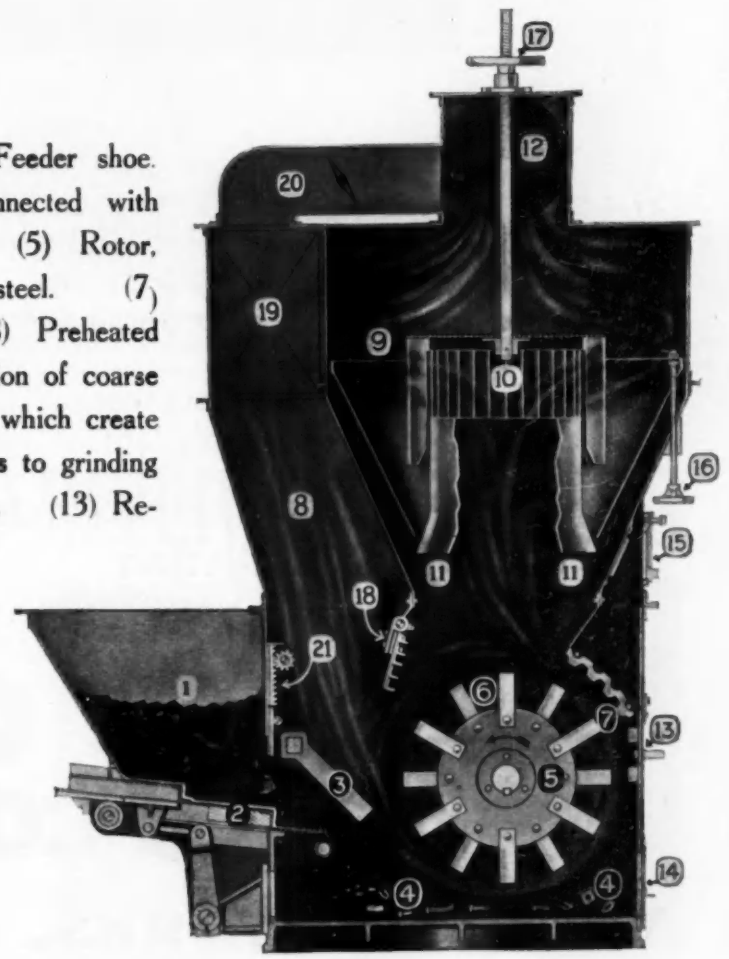

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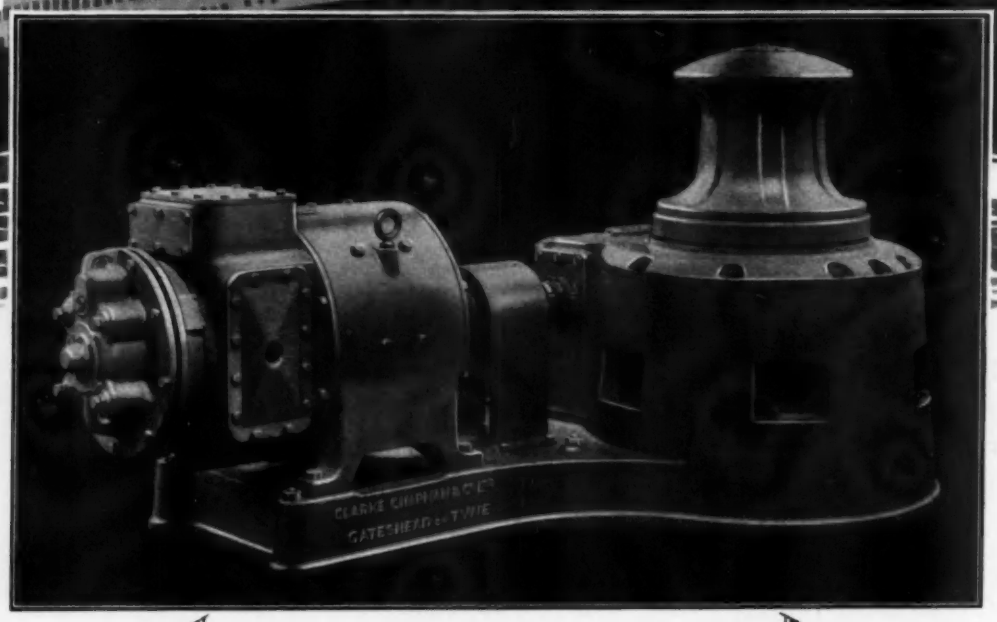

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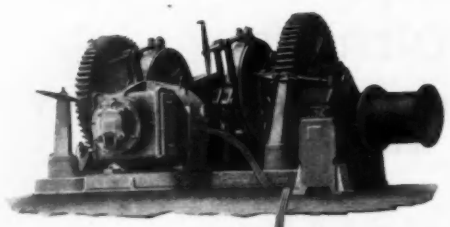
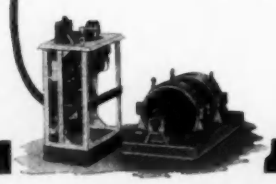


Electric Windlass with Booster Control.



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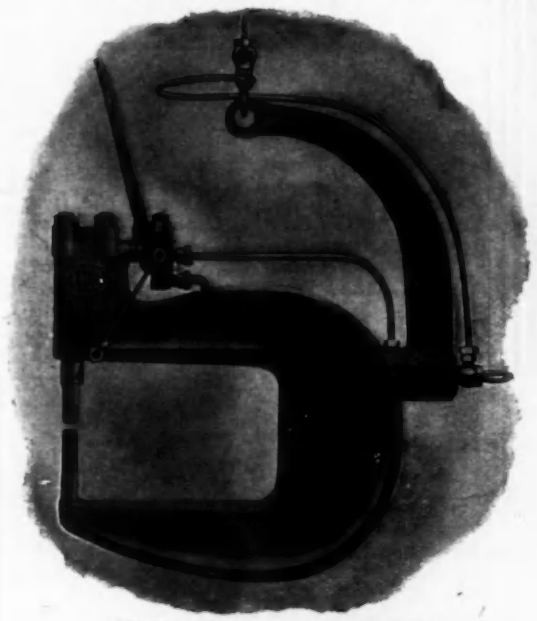
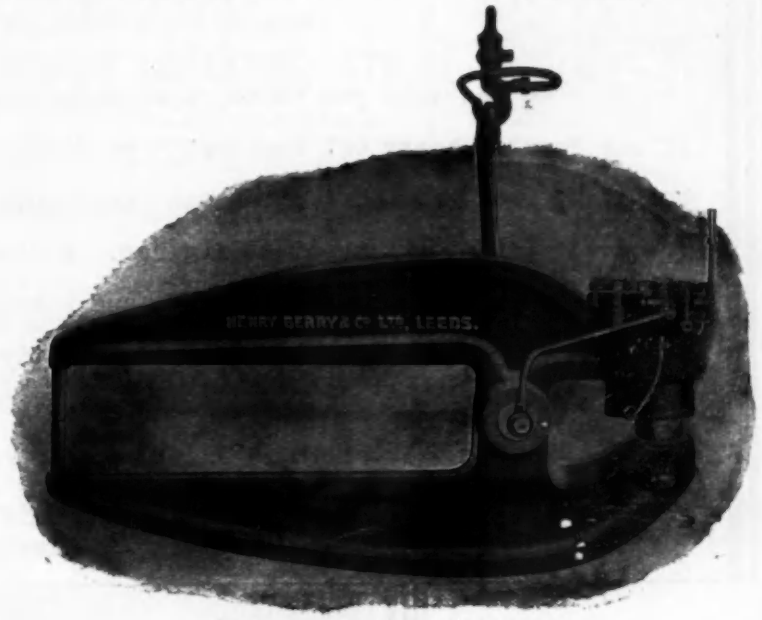
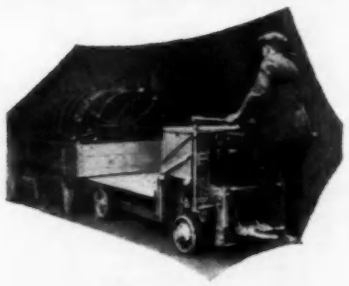


BEAR TYPE RIVETER.



HINGED TYPE RIVETER.



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Westburn Foundry, Arbroath. 11th. March, 1930.

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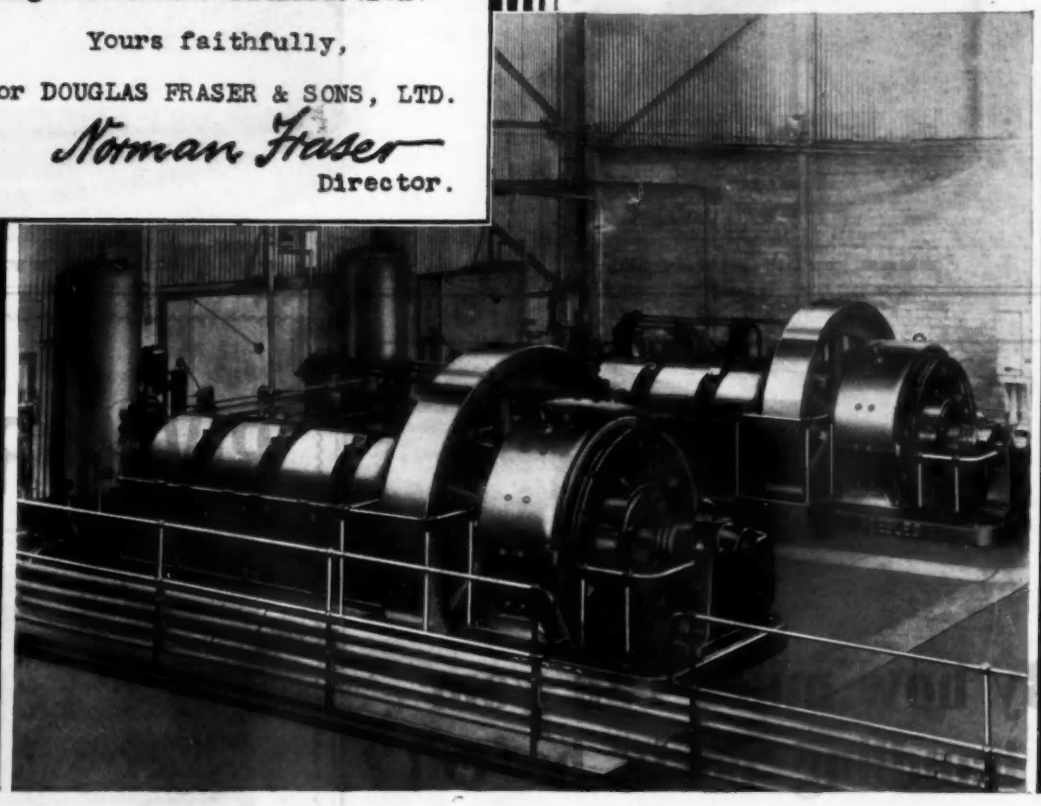

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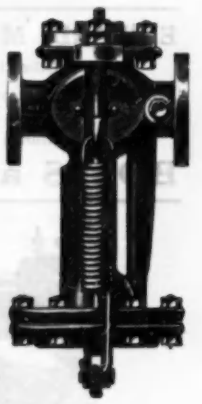

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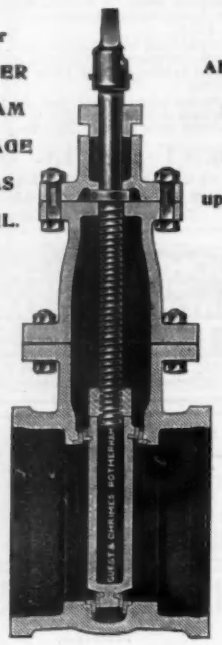

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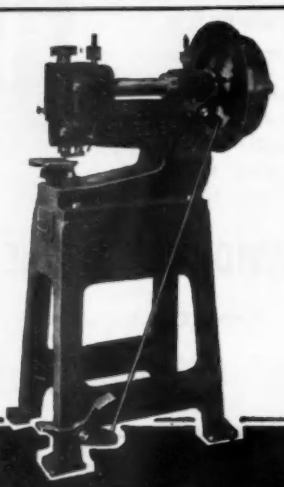

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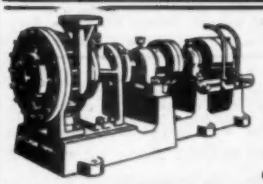

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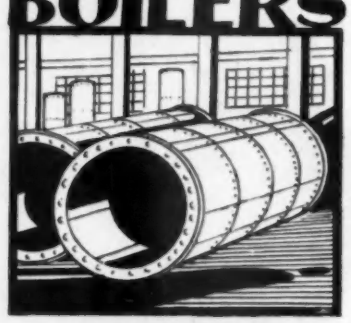

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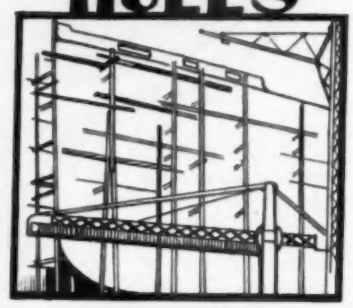

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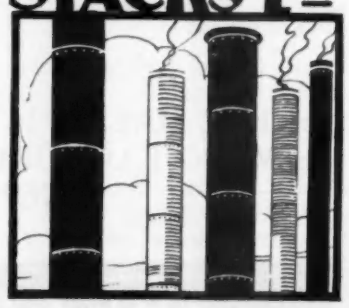

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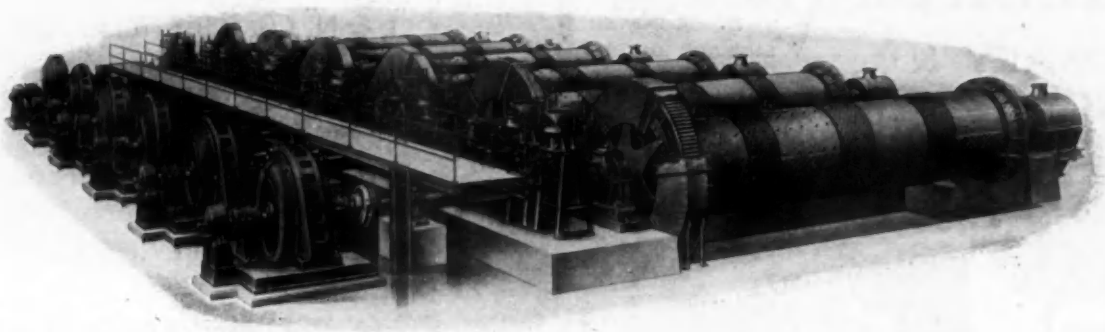

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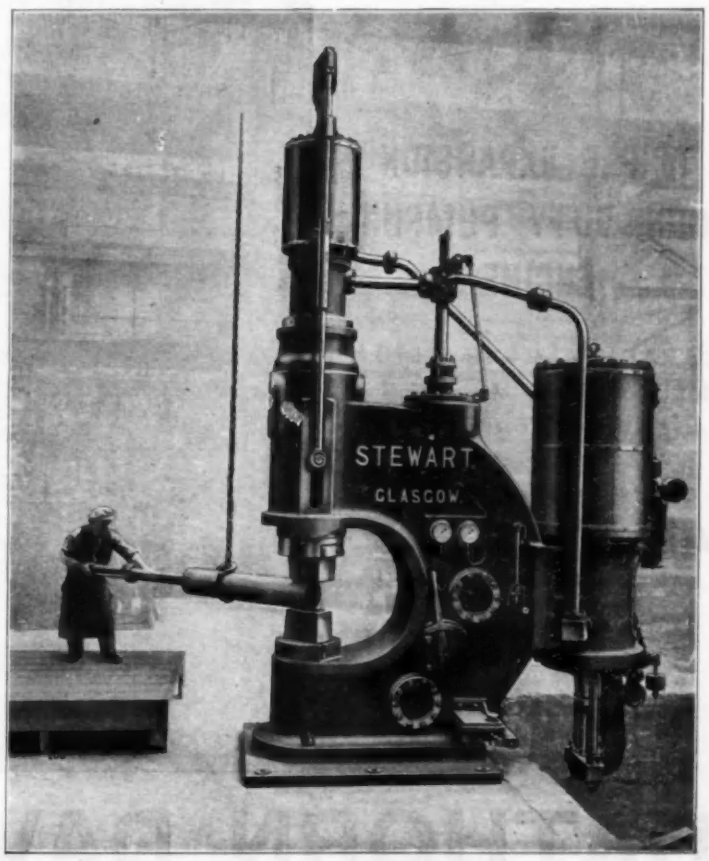

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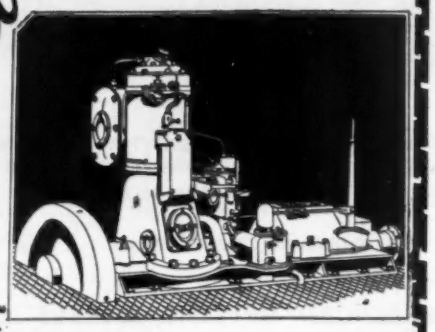

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FOR ALL PURPOSES.

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CAPACITY 24 MILLION GALLONS PER DAY AGAINST 139 FEET HEAD

— SUPPLIED TO THE —

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HATHORN DAVEY & CO., LTD.

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DOUBLE HELICAL SPEED REDUCING UNITS.

FOR REVERSING MILL.
FULL SPEED TO FULL SPEED IN 2 SECONDS
200 H.P. NORMAL
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WE ARE ABLE TO PUT AT YOUR SERVICE ONE OF THE MOST MODERN PLANTS IN THE COUNTRY FOR THE PRODUCTION OF HIGH EFFICIENCY DOUBLE HELICAL SPEED REDUCING GEAR UNITS AND FOR DOUBLE HELICAL GEARS FROM THE SMALLEST TO THE LARGEST SIZES.

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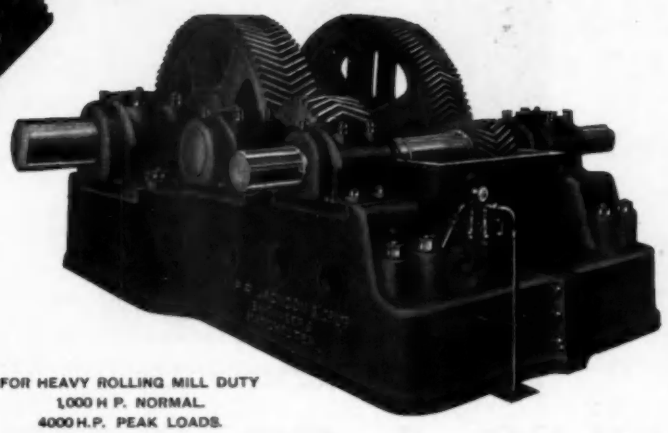

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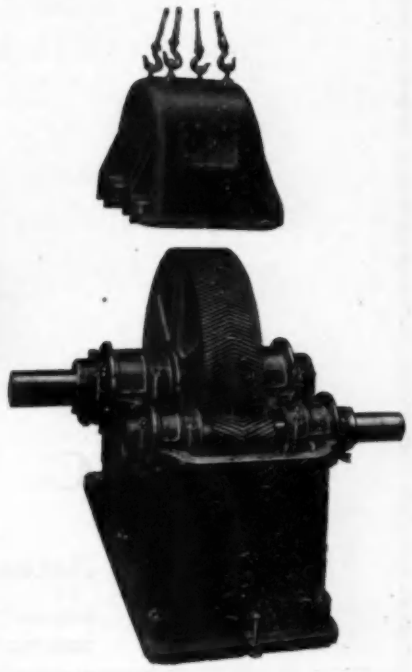

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ENGINEERS, SALFORD ROLLING MILLS,

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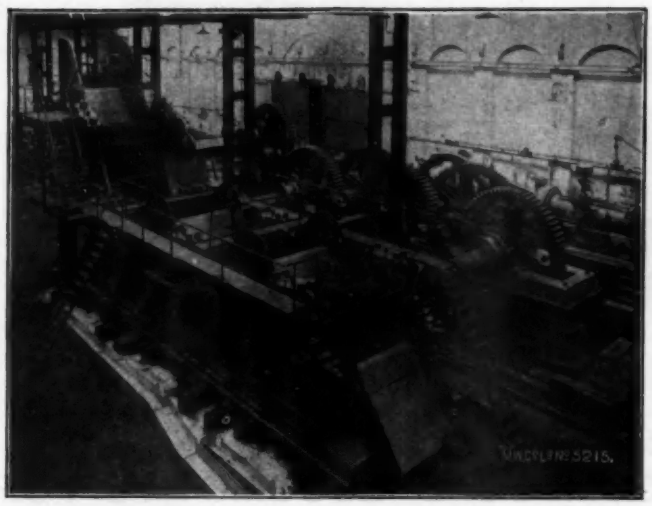
FOR ALL CLASSES SUGAR FACTORY MACHINERY



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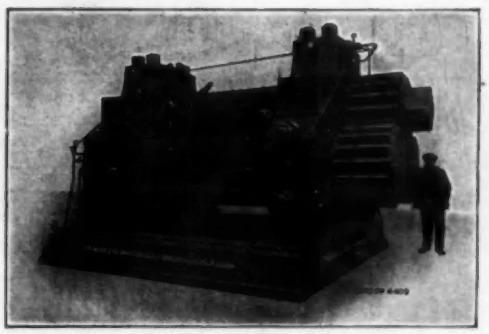
Completely erected with Meinecke Chutes and Ramsay Maceration Scrapers.

The Mirrlees Watson Co., Ltd., have now built over 2000 Mills for all parts of the World.



Heavy Duty Mills: Strong, Efficient, Reliable.

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BUILDERS OF ALL TYPES OF

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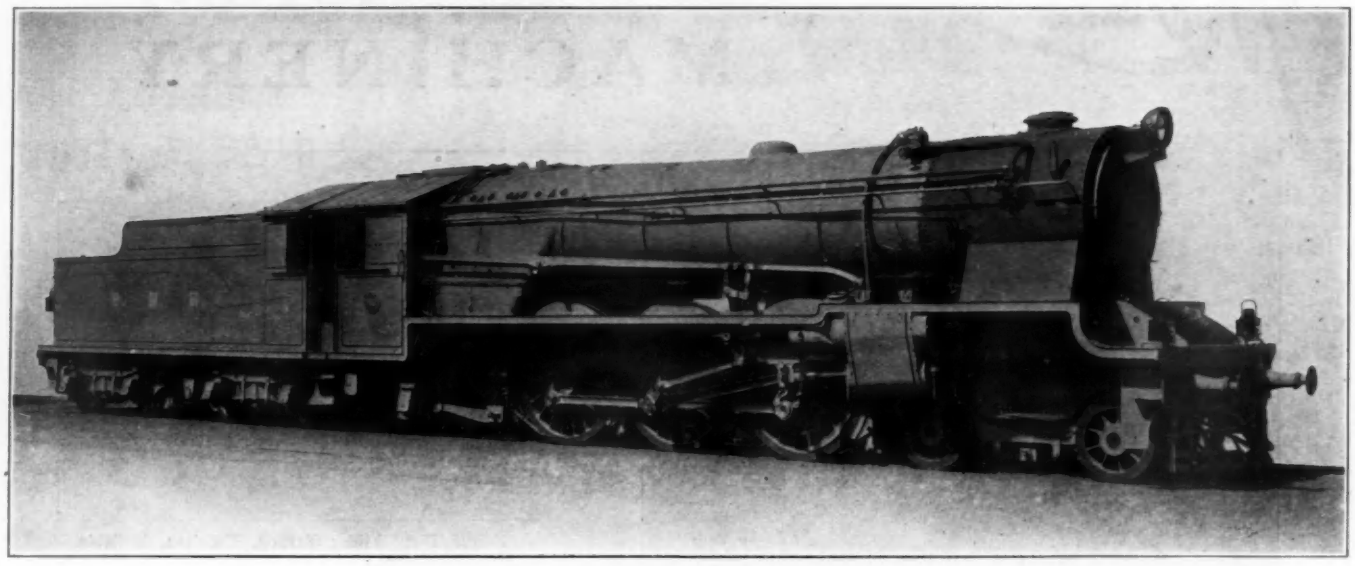

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Coupled Wheels 6′-2″ — Grate Area 51 „ „ — Fuel 450 cub. ft.

Total Weight (E & T) = 171 tons.

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Keep moving—

Old ideas must give way to modern methods. The old systems of belts and spur gearing have been overwhelmingly proved to be wasteful.

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Our modern foundry is provided with the most up-to-date handling facilities and the conditions for moulding and casting are ideal. This enables us to give:

ATTRACTIVE PRICES,
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We undertake general castings up to 60 tons weight for the engineering, chemical, electrical and other industries.

PATTERNS of sound and accurate construction supplied.

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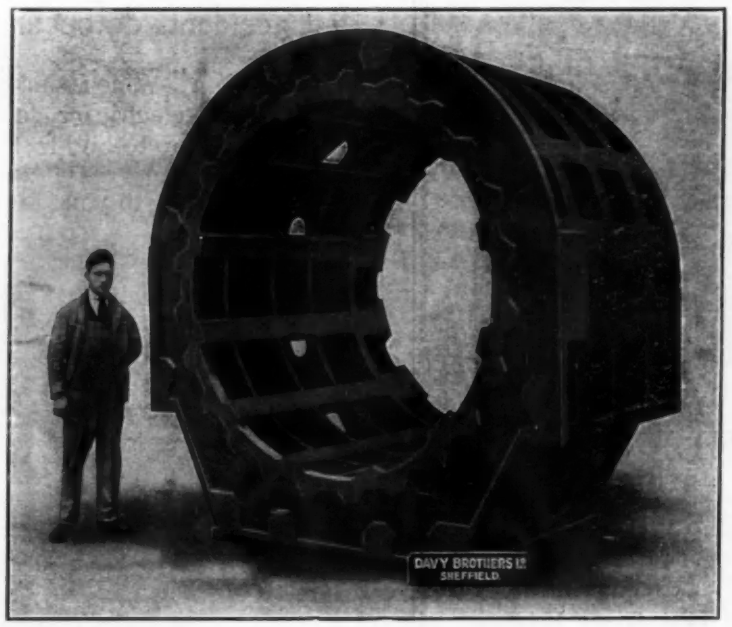

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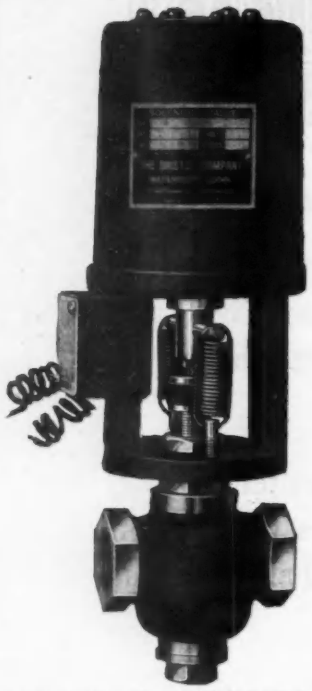

has caused lower profits and if temperature has a part in your process

BRISTOL'S CONTROLLERS

will help you to lower production costs and restore the balance of profit.

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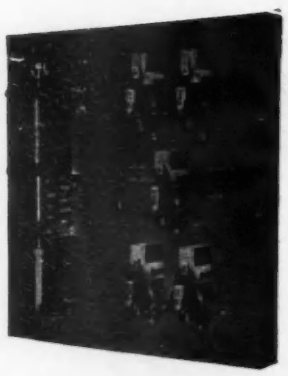

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for the control of Electrically Driven Lifts, Cranes, Hoists, Pumps, Air Compressors, &c. &c.

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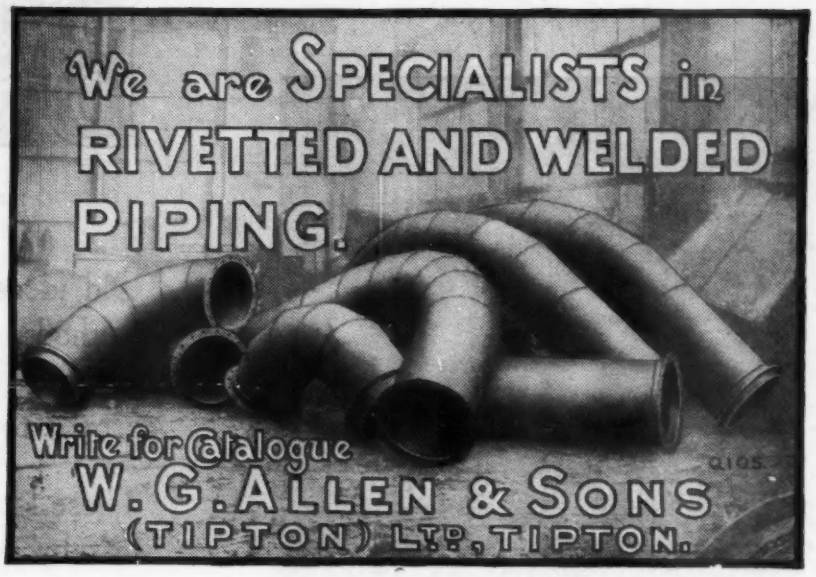


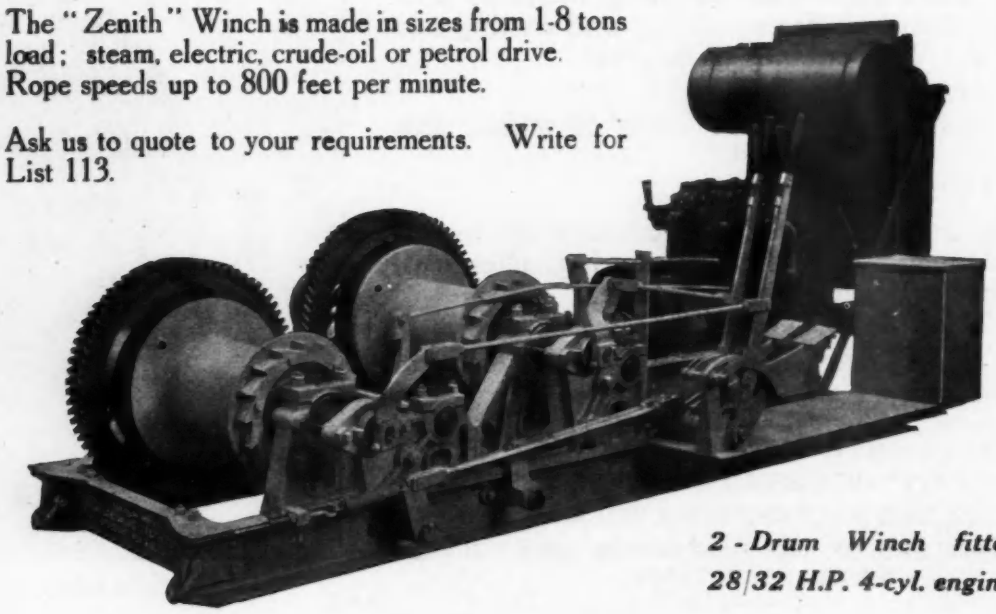
The "Zenith" **FRICTION WINCH**

has interchangeable parts

One of the features of the "Zenith" Winch is the standardisation of all parts. This means that when a "spare" is supplied, this drops into place without further fitting or trouble. Not that "spares" are often required, for "Zenith" Winches are built on such robust lines that they stand up to their work under the most exacting conditions, but accidents do occur sometimes, and then a spare is wanted.

The "Zenith" Winch is made in sizes from 1-8 tons load; steam, electric, crude-oil or petrol drive. Rope speeds up to 800 feet per minute.

Ask us to quote to your requirements. Write for List 113.



2-Drum Winch fitted 28/32 H.P. 4-cyl. engine.

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OVER **5000** SOLD IN **1929.**

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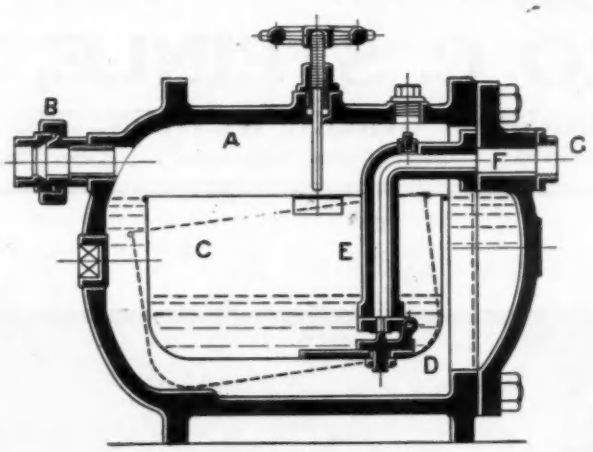

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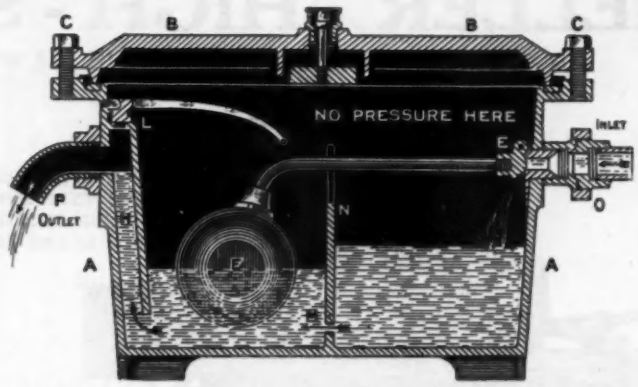
A QUICK DISCHARGE, HEAVY DUTY TRAP.



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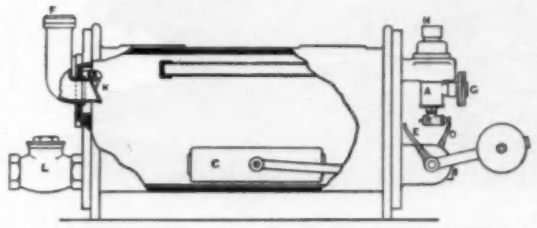

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POSITIVE OPERATION BY LIVE STEAM.

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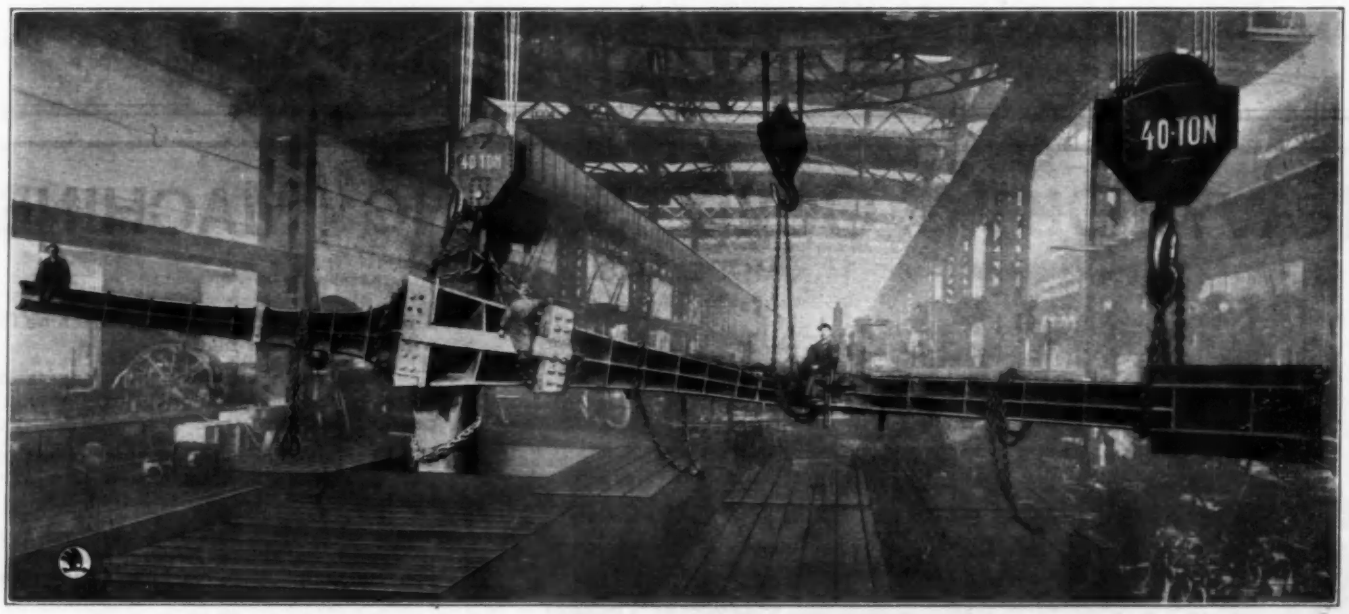

C.S. Sternframe and Propeller Bracket, assembled, total nearly 60 tons.

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A DEMONSTRATION MACHINE ALWAYS UNDER BELT IN OUR SHOWROOM.

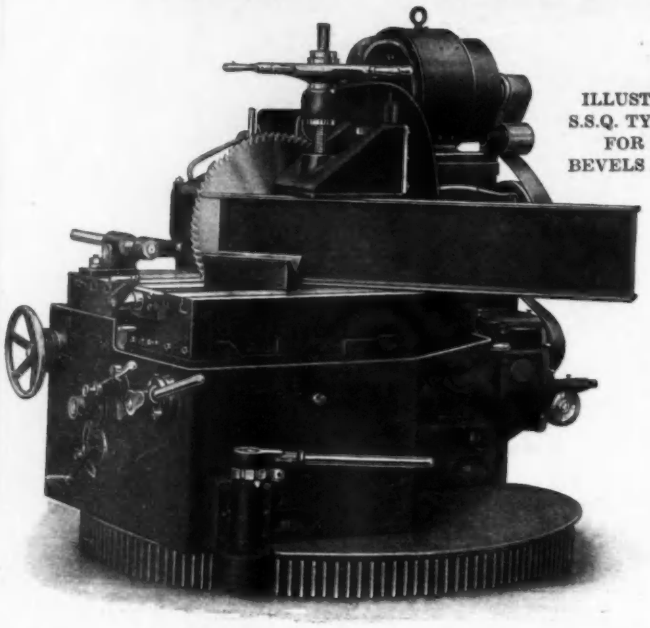

ILLUSTRATION OF S.S.Q. TYPE MACHINE FOR CUTTING BEVELS AND MITRES.

Standard Machines as illustrated made in 5 sizes.

Cutting capacities:—Rounds up to 22" dia. Standard Beams up to 30 by 16".

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Saws of various designs suitable for special classes of work such as Slicing Ship-plates, straight or bevel, ending and cutting out webs of crankshafts, frogs and switches, risers from castings, etc., etc.

Consult us regarding your Sawing problems.

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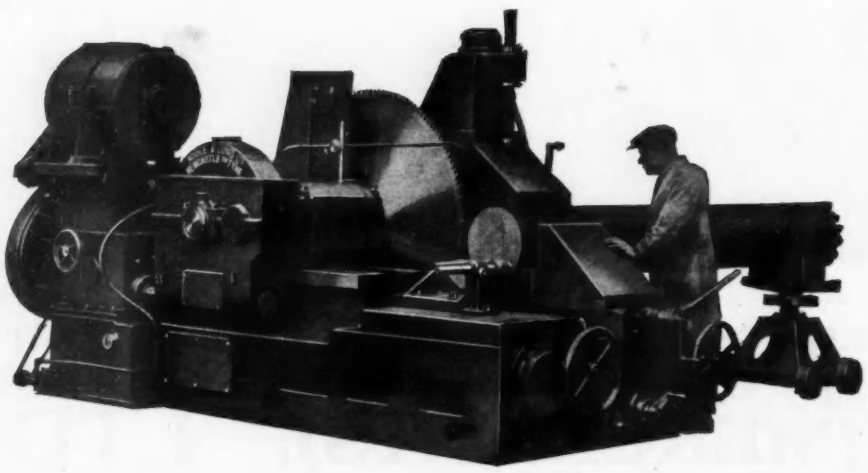
HEAVY DUTY COLD SAWING MACHINES.

MODEL C.S. 3.



The illustration shows a large machine fitted with 60" diameter blade.

The Saw teeth are formed in segments of high speed steel ensuring maximum production.

We have machines cutting steel billets up to 20" square section in 65/70 tons tensile steel.

These machines are made for rapid cutting of steel bars, billets, girders, rails, etc., and can be supplied in various sizes to meet requirements.

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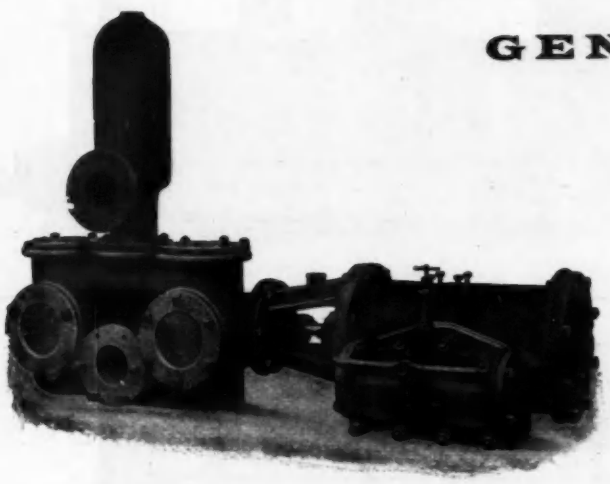

"CORNISH" STEAM PUMP for General Purposes
(300 feet pattern).

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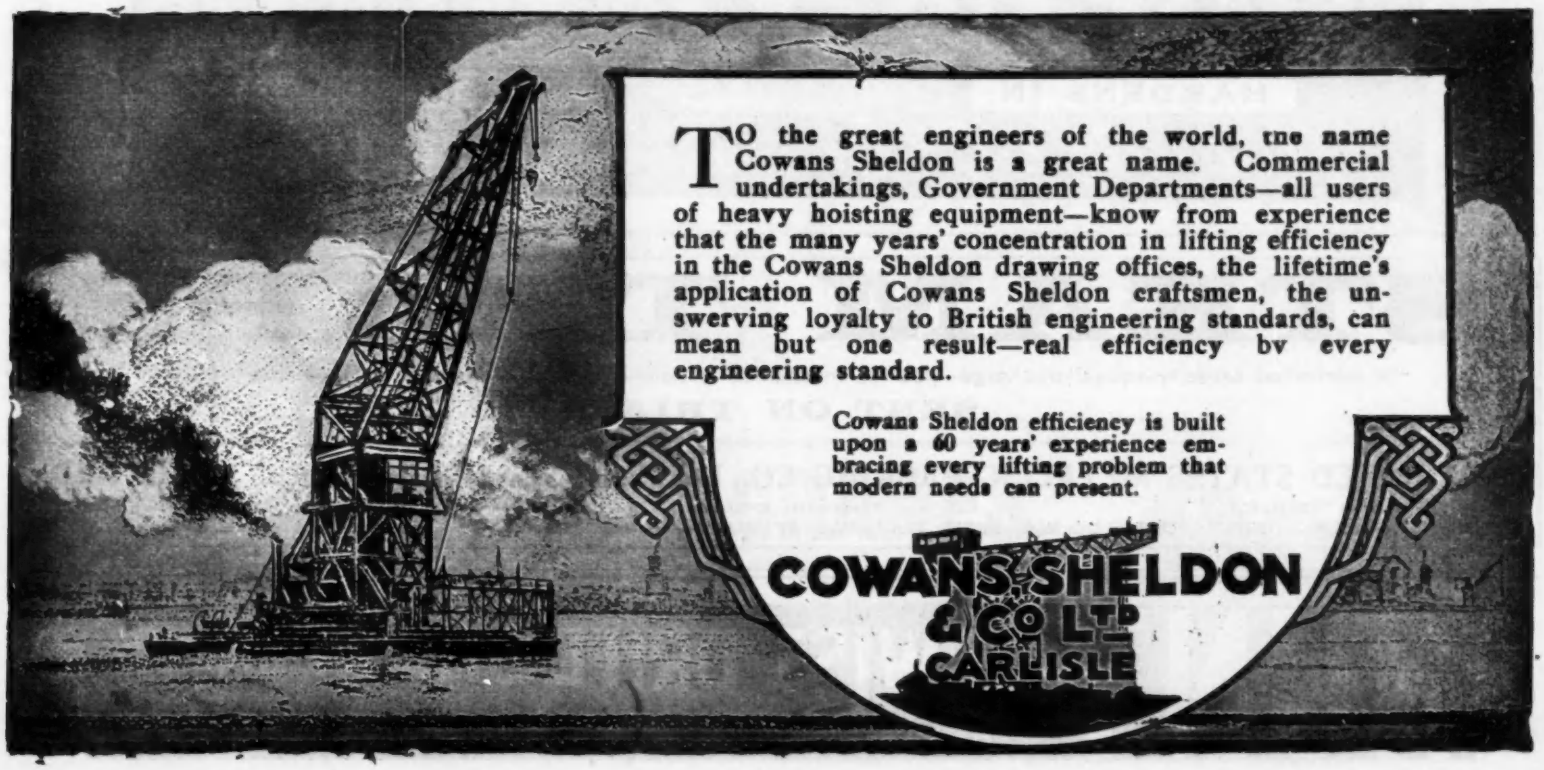
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HARD SETTING COMPOSITION.

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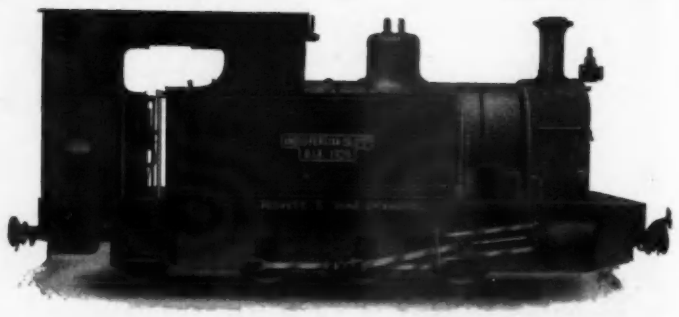

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SUPER-VITRITE

HARDENS IN ·BRAND· AIR OR OIL.

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Of unrivalled capacity—quick discharge—positive mechanical action—will do the work of three ordinary traps.

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DAVIES DEMONITE DISCS —

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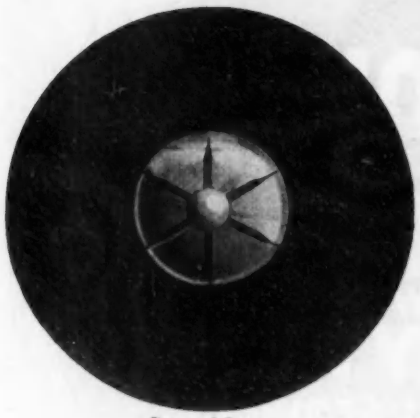

Depressed Centre.

Flat.

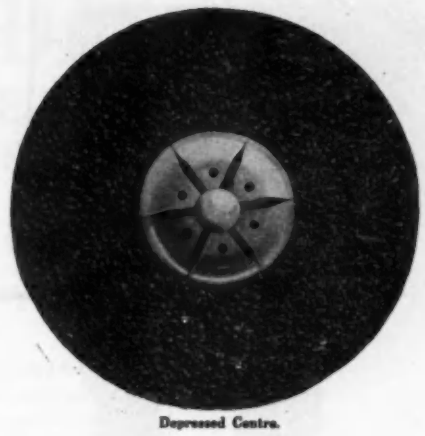

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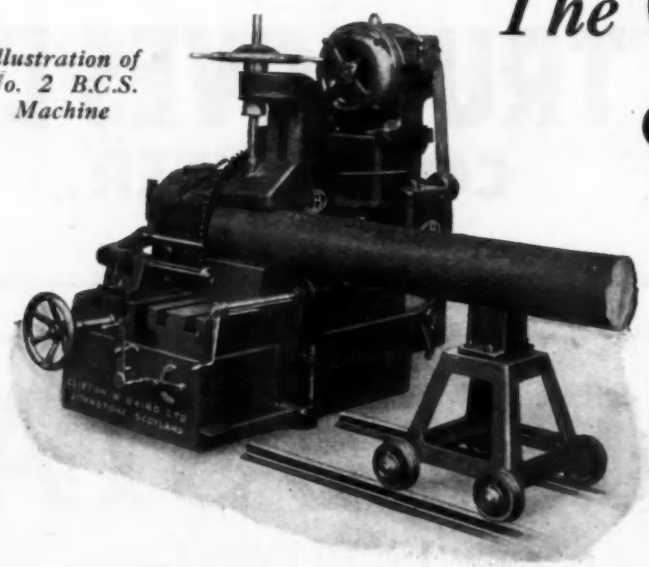
Illustration of No. 2 B.C.S. Machine



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The CB Heavy Duty High Speed Cold Sawing Machine

for Bars, Ingots and Rails, etc.

Made in sizes 20" to 60" dia. of Saw.

Actual Cutting Times

4" dia. M.S. Bar	35 secs.	Joists	
6" ,, ,,	1 min.	15'×6"	1 min.
9" ,, ,,	3½ mins.	24'×7½"	1¾ mins.
12" ,, ,,	6 mins.	95 Rail	1 min.

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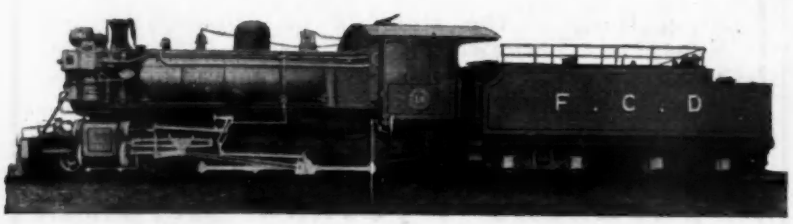

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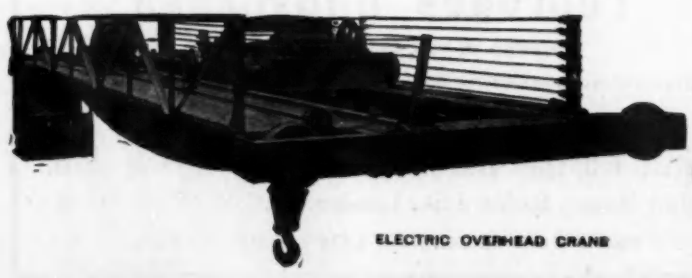

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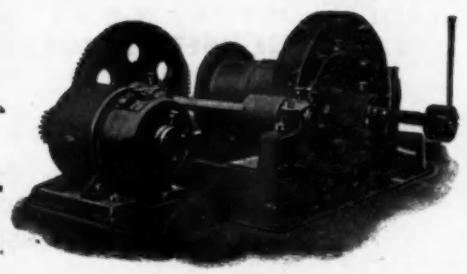

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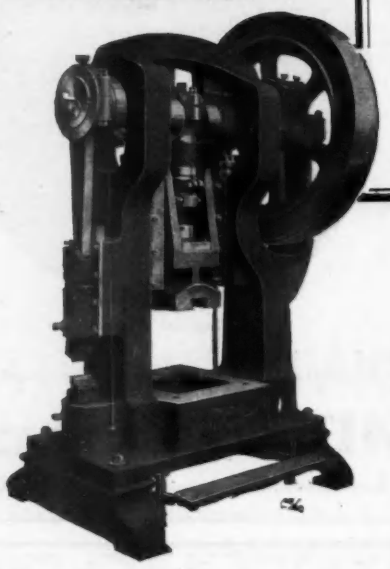

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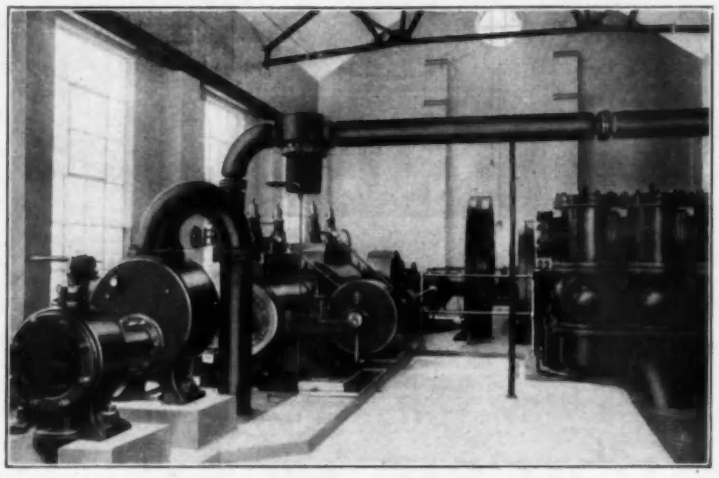

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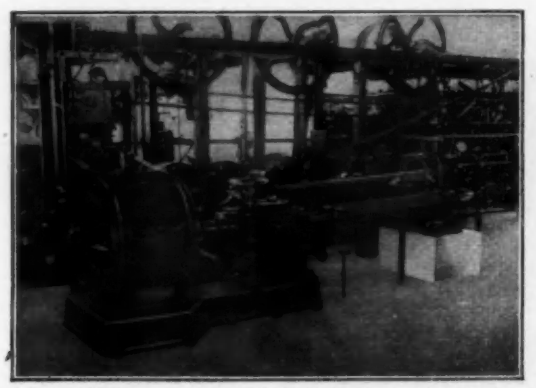

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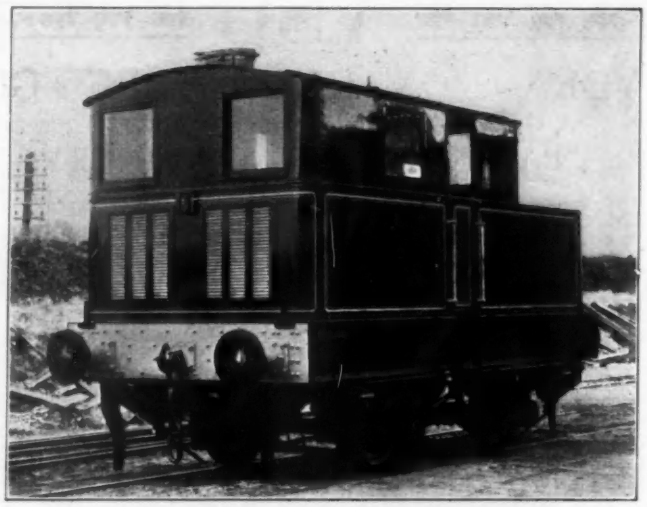

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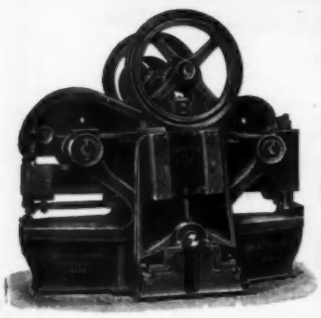

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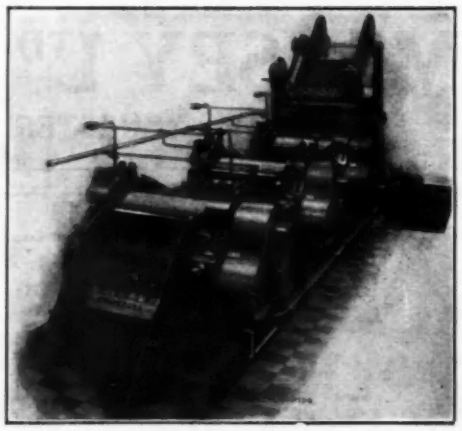

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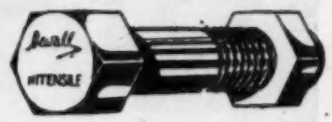

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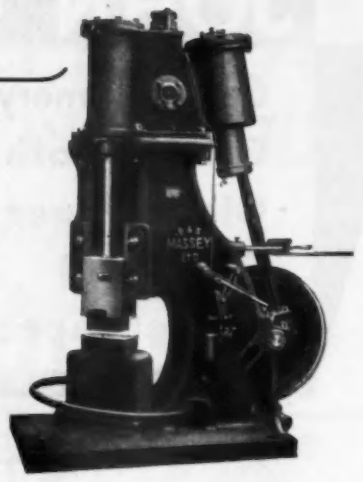

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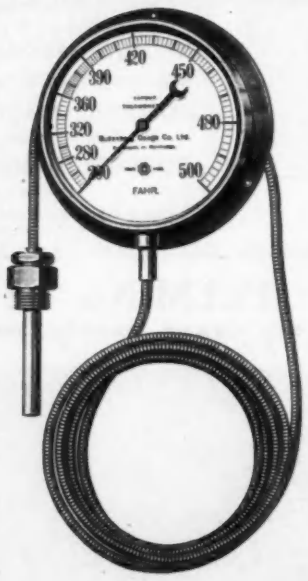

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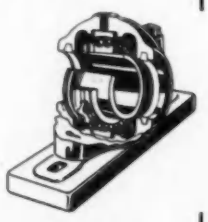

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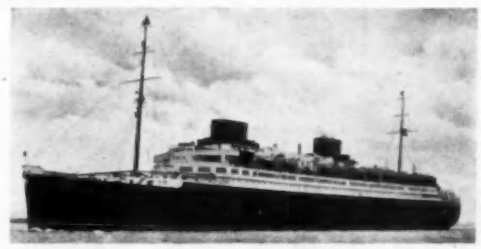

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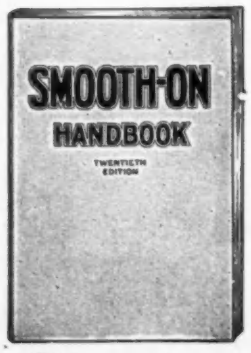

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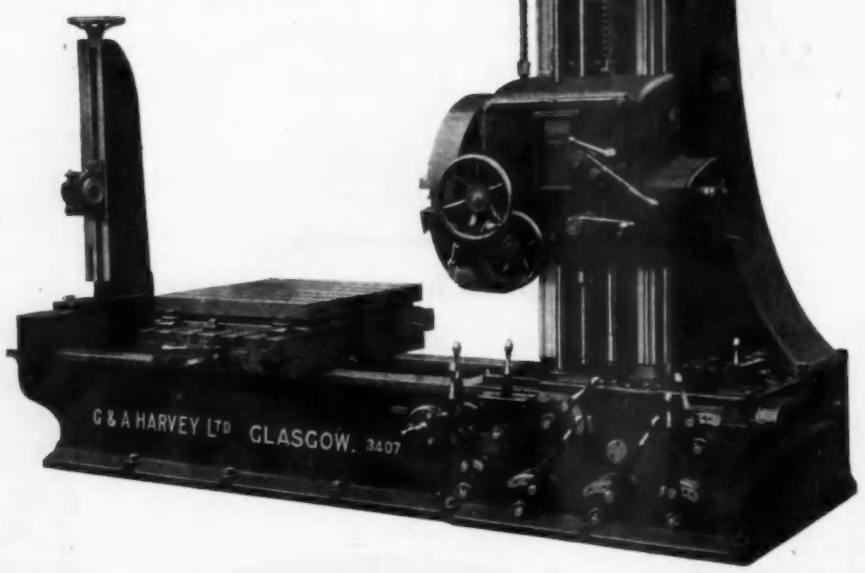

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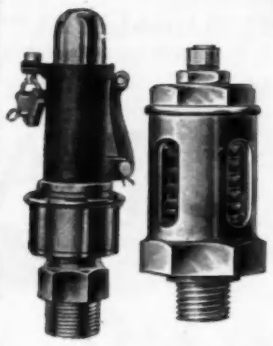

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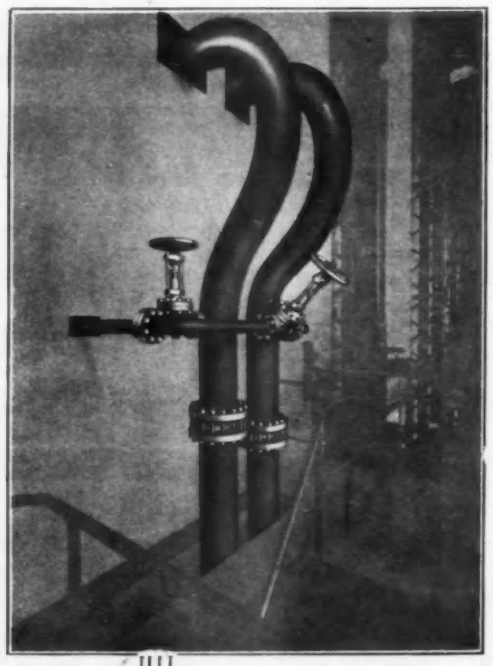

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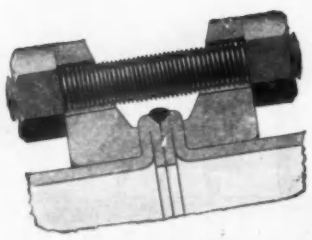

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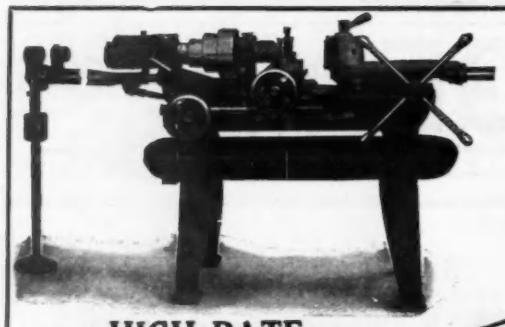

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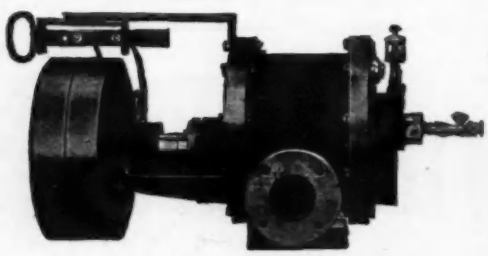

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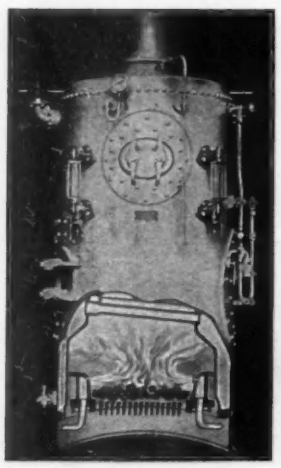

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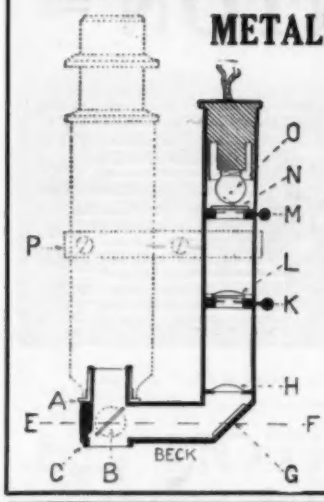

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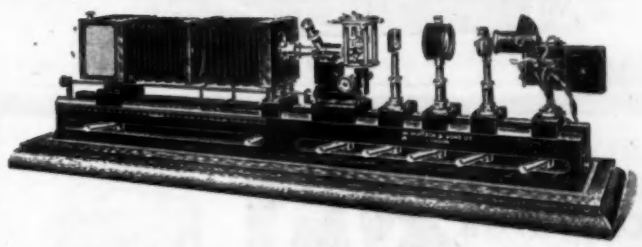

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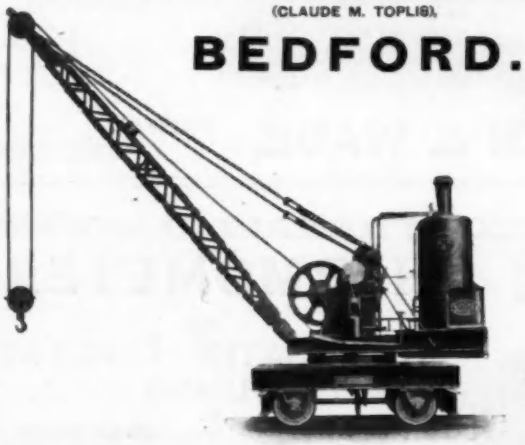

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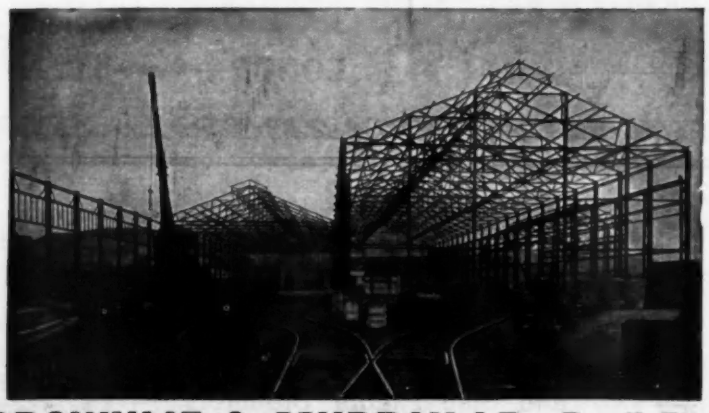

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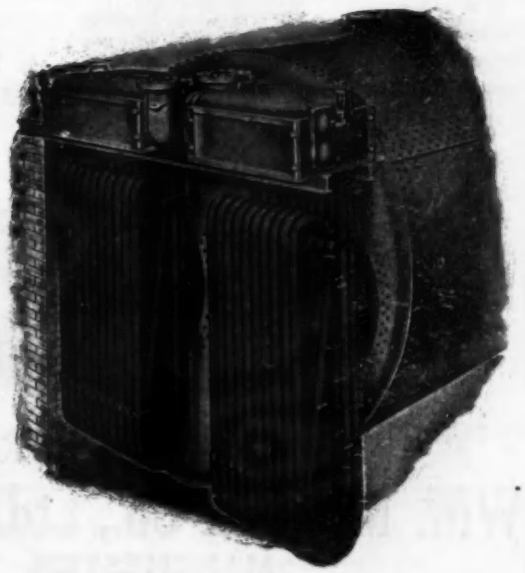

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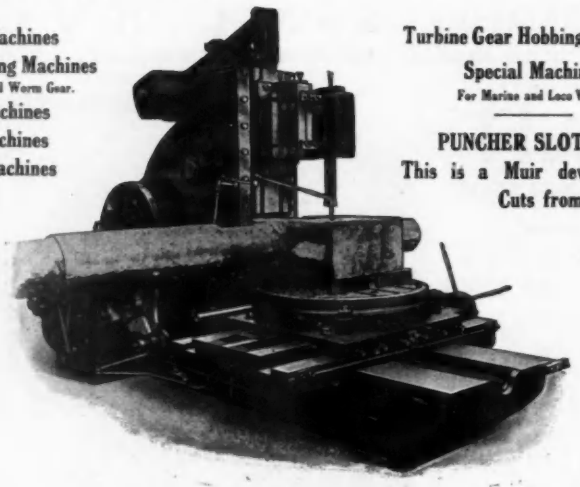

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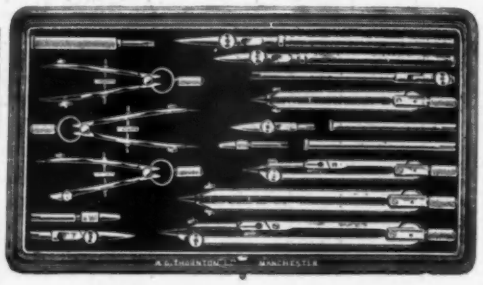

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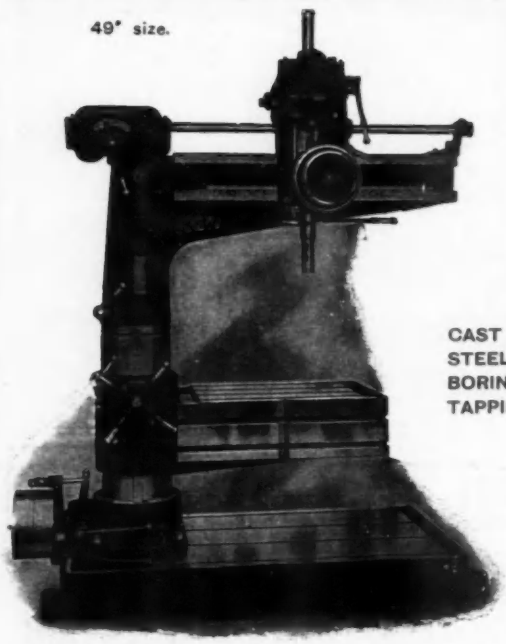

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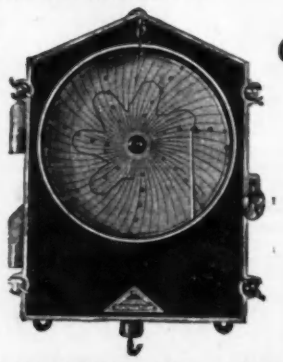

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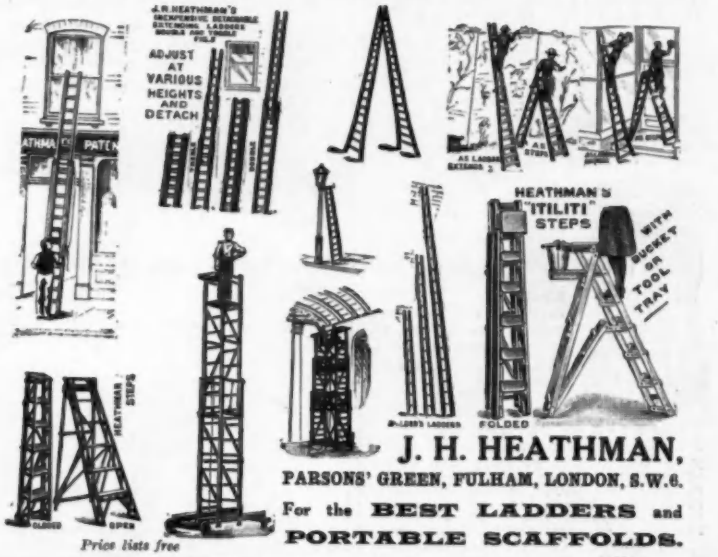

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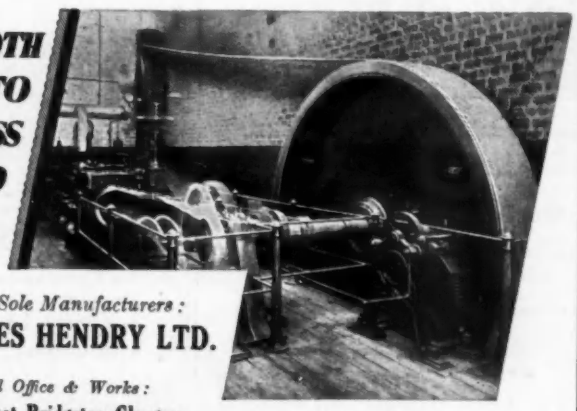

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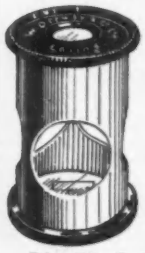

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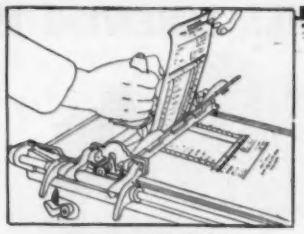

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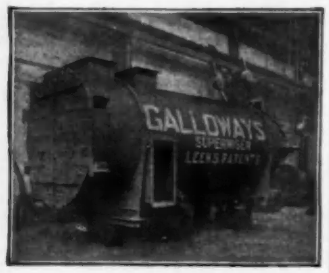

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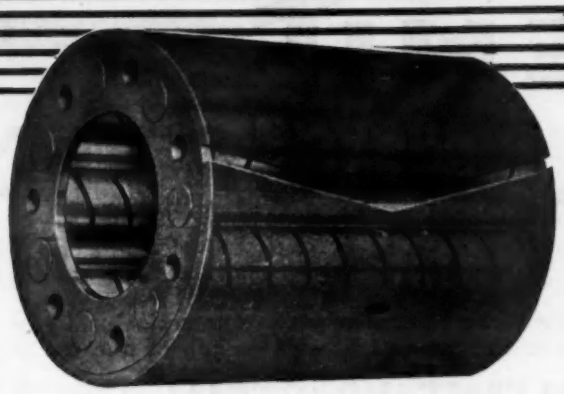

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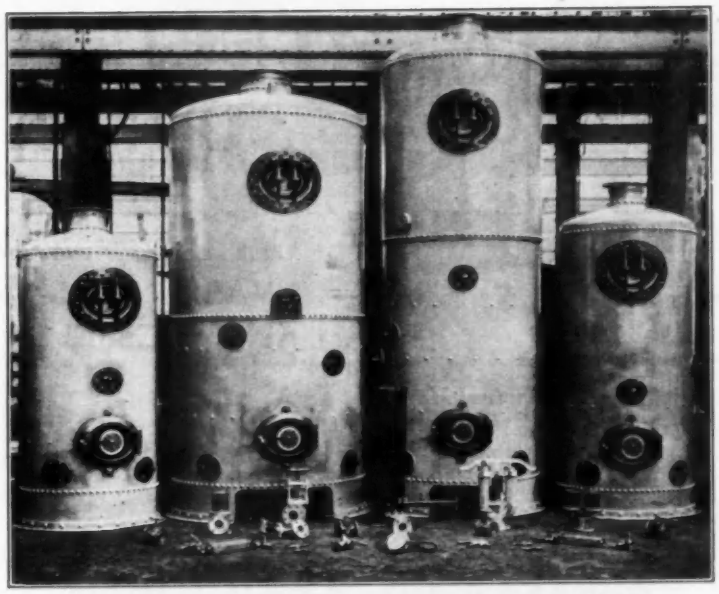

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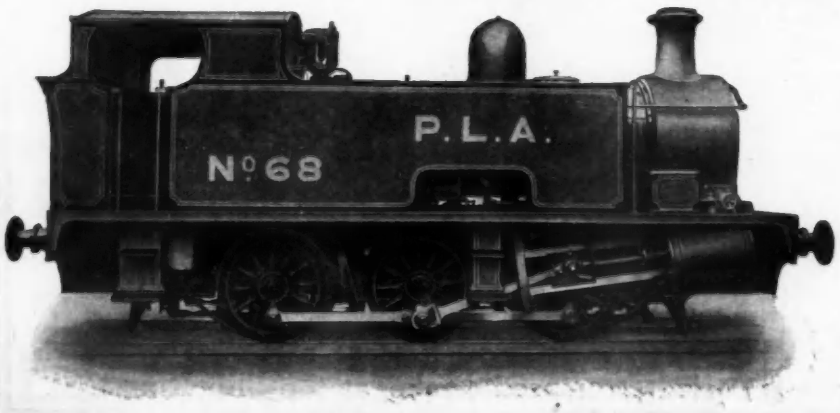

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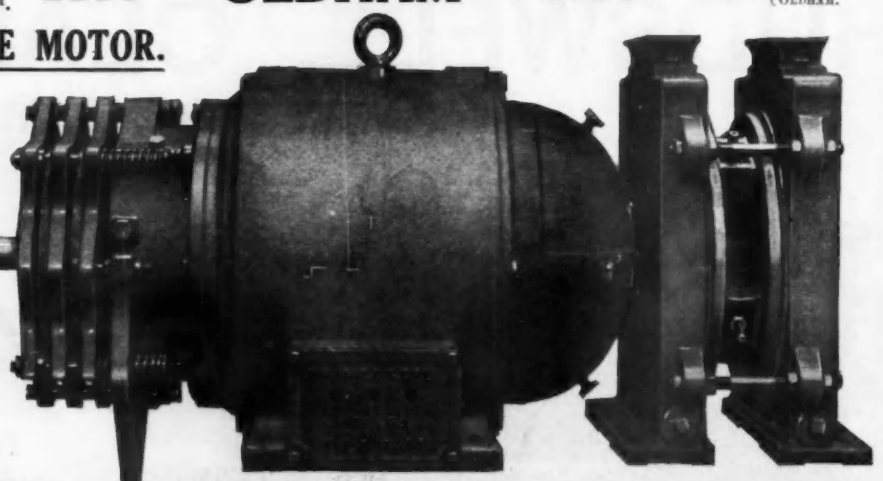

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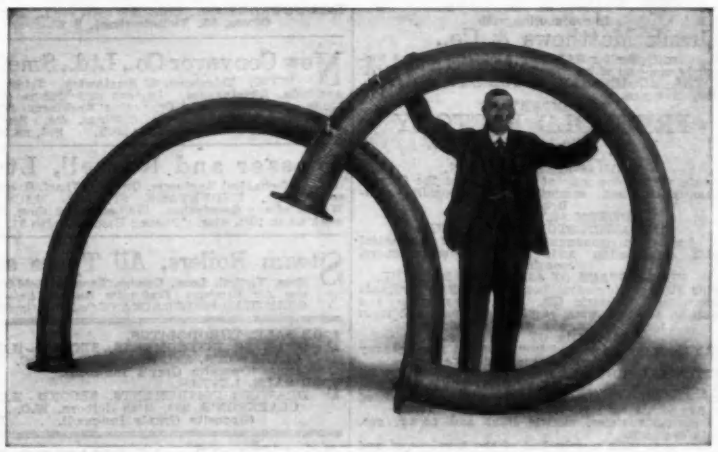

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